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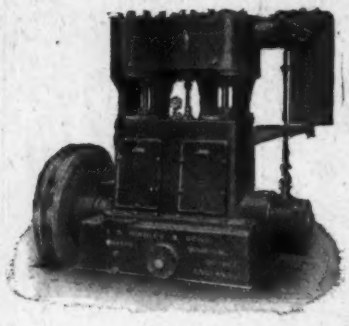

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ELECTRICAL REVIEW.

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TWO IMPORTANT QUESTIONS.

Two events have occurred during the past few days which are of considerable importance to the electrical and other engineering trades. Both are concerned with the preparations which the nation must make in connection with the work of reconstruction. The closer one gets to the inevitable problems of demobilisation and reconstruction the more serious do they appear to be. Neither the nation nor our national industries dare adopt an apathetic attitude in regard to such matters. The work of the Ministry of Reconstruction promises to become more important than that of any other section of Government, for its operations will necessarily cover practically all departments of activity, and upon the wisdom of its decisions and their timely adoption and execution must depend consequences fraught with immense possibilities for good or for evil. From the many things that we have written here already the reader is aware that this is no newly-arrived-at conviction so far as we are concerned. But no excuse is needed for returning to the subject now; indeed, our desire is to do so with greater emphasis than ever before, so that the industries which we represent may be prevented from falling into the lamentable error of delaying action which is imperatively necessary. The two events which lead us to refer to the matter now are: (1) the appointment by the Minister of Reconstruction of a special committee to report upon questions connected with the supplies of raw material that will be required by British industries in order to restore and develop trade after the war, and the best means of securing and distributing supplies, due regard being had to the interests of the Allies; (2) the approval by the War Cabinet of the report of the Whitley Committee on the relations between employers and employed, and the authorising of the Ministry of Labour to proceed with the setting-up of Joint Standing Industrial Councils. The first of these decisions is designed to ensure that our own industry in its different sections and that of the Allied countries shall have their proper share of the raw materials that may be available or reasonably in sight, so that there may be the least possible delay in finding employment for millions of workers, so that distress from unemployment shall be at a minimum, and so that we may as speedily as possible ensure industrial prosperity to help pay for the war. We in England recognise quite as well as the enemy does how vital is this matter of raw materials, and we cannot afford to let the grass grow under our feet. The second decision mentioned is closely related to the first, for while work for Labour is impossible without supplies of raw material, the latter will not yield the required results unless everything in enlightened reason is done to secure that there shall be what we

have come to call Industrial Harmony produced by the promotion of a sincere spirit of co-operation between employers and employed.

If we all consider the matter one of great urgency—there is absolutely no question in regard to merit or policy—we may feel that the time for talking has gone by, and that the period for definite action is already upon us. That being taken as agreed, what are the courses that we ought to pursue, and pursue at once?

During war time, in order that essential industries may have the wherewithal to produce what the Forces have required, the Ministry of Munitions has exercised what to all intents and purposes has amounted to rationing of essential materials. We know how great have been the difficulties and grievances of some manufacturers in consequence; it is more than probable that those difficulties and grievances might have been lessened had the organisation of our industries been more perfect. This leads us to suggest, and we desire to do so very pointedly, that when the whole of the industrial world is clamouring for raw materials for much the same purposes as we ourselves shall require them for, the difficulties and grievances will not disappear. It will be most unwise of us to expect Governments to permit a wild scramble for supplies on the part of the industrial representatives of all the nations. That would make neither for equity among the industries nor for efficiency, and we all know the harmful possibilities if prices of essential raw materials, perhaps somewhat limited in volume, were to be subject to private manipulation. Is it unreasonable, then, to anticipate that in respect of some materials which the engineering industries will require there may be a special duty devolving upon the organisations which represent those industries? In season and out of season we have tried to impress upon the electrical trade the pressing necessity for complete organisation, and to-day, looking ahead regarding the conditions under which we may have to operate for some time after the cessation of hostilities, we are compelled, in the real interests of the electrical and other engineering trades, to urge every manufacturer who so far has been content to whistle along his solitary course as an unassociated trader, to consider his ways. With absolute candour, and with sufficient reason, we may say that it is in his own immediate interests, and in the interests of the workers in his employ, that he become connected with a trade organisation, for it is through trade organisations that governments can most effectively deal when such matters as raw materials are concerned.

So much for the need for organisation. Now let us turn to the question of the Whitley report on industrial co-operation. We ought to be able to assume that every responsible head of a manufacturing firm has made himself acquainted with the recommendations of the Whitley Committee, which were put before the trade organisations some months ago, and which were editorially referred to in the Electrical Review for July 6th and August 24th, 1917. If we are not right in making that assumption, we can only regret it and urge that every such representative, whether his be an associated or an unassociated business, secure a copy from the Government publishers at once. There has been so much general talking about industrial harmony during the past two years that no more of it is needed in manufacturing circles, for surely every manufacturer sees by now that there will not be anything approaching industrial peace unless appropriate, sympathetic, and far-seeing measures are taken to ensure it. What, then, is the next step? The Government has made it clear that in many of its future industrial negotiations it will give preferential consideration to industrial organisations in the councils of which Labour has its representatives. Accepting this decision as irrevocable and as correct, it seems to us that the right course for the organisations which represent electrical and engineering industries is to call in suitable representatives of Labour to consider with them the whole question of these Standing Industrial Councils which are about to be set up, and prepare the way for smooth development along the lines of the adopted recommendations. We shall thus leave the period of general talk on co-operation and get down to something definite out of which what we all aim at may be carefully and amicably evolved. We trust that such conferences will soon be arranged on this particular matter in the electrical and engineering circles. The scheme can be more easily applied if the necessary measures be initiated through the medium of strong and representative organisations. Therefore, we arrive at the conclusion that what is called for by these two problems—raw material supply and industrial unity—is more complete organisation of manufacturers and their co-operation with Labour. We have scattered our efforts far too long—the reasons matter little to-day—this is the time for concentration, and for serious constructive operations based on the Whitley proposals now endorsed by the Government.

Government Shareholding in Germany.

One of the first instances of great importance in which the German Imperial authorities have taken up a considerable financial interest in an electricity supply undertaking has just arisen. It concerns the Elektron Works Co., which is utilising extensive lignite deposits in the vicinity of Bitterfeld as fuel in connection with the production of electrical energy, particularly, if not exclusively, for one or two of the Government works in that district for the fixation of nitrogen. The shares in question were formerly owned by the Berlin Electricity Works Co., and were part of the directors' scheme for participating in electrical undertakings for the purpose of possessing other electrical interests in the event, which in the meantime has taken place, of the Berlin works and plant being acquired by the Berlin Municipal Council. During the course of the present year, however, the A.E.G. relieved its subsidy of these shares, partly by a cash payment and partly by an exchange of shares, and in its turn the A.E.G. has been constrained to transfer the shares to the Imperial authorities. At the July meeting of the A.E.G. it was mentioned that negotiations were proceeding in regard to a change in the situation respecting the shareholding in the Elektron Works, and it is now stated that the entire interests have been sold to the State for the reason, as given, that the Empire needs the production of energy at the works in question for war purposes. The A.E.G. is said to have been compelled to make moderate sacrifices on the transfer, which have already been provided for in the accounts, and to have renounced the right of repurchasing the shares which the company possessed.

According to later information the State has acquired all the shares issued by, and the credits advanced to, the Elektrowerke by the Berlin Electricity Works Co. and the A.E.G. It is stated that the purchase price is understood to range from £2,000,000 to £2,500,000, although the form in which the payment has been or is to be made has not yet been disclosed. The expropriation of the undertaking will permit of the closest co-operation between this lignite power station and the Imperial nitrate works, to which power has been delivered at contract prices which, owing to the growth in working expenses during the war, left no profit to the company.

C. H. WORDINGHAM,

President of the Institution of Electrical Engineers.

The new President, Mr. C. H. Wordingham, is one of the veterans of the electric supply industry in this country, having begun his professional career under particularly auspicious conditions as the only pupil of that great pioneer, Dr. John Hopkinson, and returning, after a spell of experience with the early supply of electricity in London, and in the construction of telephone exchanges, to become his chief assistant.

Educated at King's College School, followed by some years at King's College in the Department of Applied Sciences, Mr. Wordingham earned his A.K.C., and throughout his career has shown a practical interest in his old college. The college authorities have no less shown their appreciation of their old pupil by electing him to a Fellowship and to a seat on the Council.

Elliott & Fry] C. H. Wordingham. [London.

Receiving his baptism of fire at an early age when the Grosvenor Gallery power station was burnt down, Mr. Wordingham went through the experience of the change-over to Deptford, and he was thus intimately connected with the first large-scale extra-high-tension system in this country. After removal to Deptford, he took charge of the standardising department—an early indication of the important assistance to the cause of standardisation which the President later on was so largely to contribute. Returning to Dr. Hopkinson, the supervision of the contracts for the Manchester and Whitehaven power stations fell to him, and in 1894, at the invitation of the Corporation, he became chief at Manchester, the original power station being then a mere 2,000 KW. or so. In the years that followed, the developments at Manchester ran up to 50,000 KW., and included the practical working-out of a three-phase system for lighting, traction and power over a district of some 45 sq. miles. In a report to the Corporation as long ago as 1896, Mr. Wordingham advised the adoption of a three-phase, 10,000-volt system—subsequently reduced to 6,600 volts—and he laid down the essential economical principle of concentration of plant in one large power station; he thus sowed the seed which has produced the present harvest in Manchester, where, under the control of Mr. S. L. Pearce, one of the finest and most successful municipal undertakings in the world has been established. The President's advice became then in much demand, and he determined to set up a consultative practice; a busy and useful two years followed—then the "Destiny that shapes our ends" brought about the unexpected in the shape of an invitation from the Board of Admiralty to become their first civilian electrical engineer-in-chief, which Mr. Wordingham felt compelled to accept. Those who know of the great work he has done there in the years that have followed can testify to the successful result of the President's labours. An entirely new department had first to be organised, at a time when the application of electric power in the Navy was only just beginning—of fire control and similar telegraphs on board ship there was then no trace. The new chief at once introduced parallel running of generators, raised the pressure from 100 volts to 220 volts, introduced paper-insulated cables, developed an entirely new system of distribution, and radically re-designed old fittings, besides introducing many new fittings of a very special design, and he also succeeded in getting the Admiralty contracts submitted to competitive tenders on definite specifications. His was the great responsibility of the design and supervision of contracts for the electrical equipment of all His Majesty's ships, and he has had the unique experience of having seen his designs and arrangements satisfactorily withstand the supreme test of action with the enemy. Not only has this responsibility covered the electrical equipment for all kinds of purposes of the greatest Navy in the history of the world, but since the first installations at the Admiralty Dockyards carried out by Messrs. Preece & Cardew before the appointment of the Electrical Engineer-in-Chief, the President has been adviser to the Admiralty on all matters of power supply and lighting in all their land establishments, including the whole of the work for the great Dockyard at Rosyth and the numerous naval air stations established throughout the country. It is an appropriate year for the Institution of Electrical Engineers to place in the chair one who has done so great a work for that "sure shield"—our incomparable Navy—on which civilisation itself depends.

The President has ever been a hard worker in the interests of the Institution—the only touch of sadness being that his mother, who was such a constant and devoted companion to her son at the conversazioni and other public functions, is not here now to welcome his new dignity. He is one of the oldest members of the famous Wiring Rules

Committee, and has laboured for the Institution in many other ways. If he has served the Institution well, it may also be said he has served the industry even better. Very few people perhaps realise the enormous energy which Mr. Wordingham has put into the work of standardisation; so long ago as 1898 he read a paper on "The Necessity for Uniformity of Plant and Apparatus," and in 1902 he was invited by the late Sir William Preece to join the Engineering Standards Committee. For 15 years the President has given his best to this cause, and many British standard specifications are the visible result of the labours of the many Sub-Committees over which Mr. Wordingham presides.

The second President of the Municipal Electrical Association, now grown into the Incorporated Municipal Electrical Association, the esteem in which Mr. Wordingham is held by municipal engineers was shown by his election as one of the five Honorary Members of that Association. Chairman, also, of the Electrical Research Committee, founded under the auspices of the Advisory Council of Scientific and Industrial Research, he has embarked on a work of national importance, which will be of practical assistance to the electrical industry. Whether from his general courtesy, his invariable kindliness, his wide experience in engineering, his great interest in research, and unceasing labours in the cause of British standardisation and the advance of the British electrical industry, the members will feel that they have done wisely in electing Mr. Wordingham to the highest distinction they can offer him.

THE FIXATION OF ATMOSPHERIC NITROGEN.

(*Continued from page* 342.)

The Schönherr-Hessberger Process—This process utilises a linear arc, the furnace containing a central iron tube, water-cooled at the top, and a movable bottom electrode, also of iron. The arc plays between the bottom electrode and the upper, water-cooled part of the top electrode. Air entering the furnace is heated to 500° C. by a jacket of hot gases; inside the central tube the temperature is 3,000° C., and that of the gases leaving the cooler and passing into the pre-heating jacket, is about 1,200° C.

This furnace is more robust than the Birkeland furnace, and does not require a magnetic field (which consumes 10 per cent. of the energy supplied to a Birkeland furnace). Nevertheless, Eyde states that the net efficiency of the Schönherr furnace is practically equal to that of the Norwegian furnace.

In the Christiansand works, making only sodium nitrite by the action of gases at 300° C. on caustic soda, there are 12 450-KW. Schönherr furnaces utilising A.C. at 4,200 volts, 50 cycles, and working with an arc 16 ft. in length. At Saaheim there are 96-KW. furnaces with 20-ft. arcs, the total length of the furnaces being nearly 40 ft.

The Pauling Process.—Water-cooled iron electrodes, resembling a horn-type lightning arrester are mounted inside an oval chamber, through which air is blown from bottom to top. Alternating current at 6,000 volts, 50 cycles, is used, and the arc assumes a fan-shape. Furnaces ranging from 400 to 4,000-KW. rating are used at Gelsenkirchen (Westphalia). The French "Le Nitrogène" Co. uses furnaces of 600 and 1,000 KW. at Roche de Rame. Three 1,100-KW. and one 2,000-KW. furnaces are used at Nitrolée (U.S.A.); other furnaces of the same type are used at Innsbruck, Milan, Chippis, and in South Carolina; and a 15,000-KW. plant capable of producing 6,000 tons of nitric acid per annum has recently been installed at Muldenstein (Saxony).

The Naville-Guye furnace is of the same type as the Pauling furnace, and yields 1,200 to 1,230 lb. of nitrogen per KW.-year. An inverted V-shaped arc is produced between horn electrodes, through which the gas stream is constricted. The Moscicki furnace, with a magnetically rotated arc, is not used extensively, but is employed in the Bodio Works of the Neuhausen Co.

The Hausser Process.—Although this process has not been used on an industrially important scale, it is worth mentioning, because the high temperature requisite for direct oxidisation of nitrogen in a mixture of nitrogen and oxygen is not obtained by the electric arc, but by explosion of a combustible mixture of gas and air. A mixture of town gas, air, and oxygen compressed to 45 lb. per sq. in. develops a maximum pressure of 325 lb. when exploded. The burnt gases are at once cooled by expansion to prevent decomposition of the oxidised nitrogen. The yield is equivalent to about 15 gm. of nitric acid per cubic metre of gas at the outlet of the apparatus. For the sake of cheapness, Hausser proposed to use coke oven gas instead of coal gas, but the yield per cubic metre of gas of 4,100 calories thermal value is only 170 gm., which corresponds to a much lower efficiency than is obtained in the arc processes. One wonders, however, whether there is a possible application for the Hausser process in conjunction with explosion turbines.

Direct Synthesis of Ammonia: Haber's Process.—Prof. Le Chatelier took out a patent concerning the synthetic manufacture of ammonia in 1901, but owing to a serious laboratory accident he abandoned his researches before bringing his results to an industrial basis. As subsequent events have shown, this was particularly unfortunate. The problem was again attacked by Haber in 1908, and, with the immense resources of the Bädische Anilin and Soda Fabrik at his disposal, this investigator achieved a success so complete that the Germans are now producing at Oppau (near Ludwigshafen) at least 60,000 tons per annum of combined nitrogen, corresponding to 300,000 tons of ammonium sulphate. The latter is now produced at £6 per ton, where it formerly cost £16 per ton, and it is largely owing to the Haber process that Germany has been able to make fertilisers and explosives in spite of the Allies' blockade. The total cost of £6 per metric ton is due principally to the cost of materials employed; thus 476 lb. of nitrogen = 6s. 6d.; 102 lb. of hydrogen = 46s. 6d.; 1,662 lb. of sulphuric acid = 37s.; manufacturing cost = 32s.; total, £6 2s. per ton of ammonium sulphate.

The direct synthesis of ammonia from nitrogen and hydrogen, bristles with technical difficulties, both of materials and of processes, but all the difficulties have been overcome and the vital secrets are guarded effectually by the Bädische works. Both hydrogen and nitrogen are now available cheaply on an industrial scale, and the Haber process, though it demands close and highly-skilled supervision, does not necessitate high temperature or very cheap electrical energy, yet it produces combined nitrogen at very low cost, and is a correspondingly serious rival to all other processes. The direct combination of nitrogen and hydrogen under stable conditions is made possible by aid of a catalyst, osmium, uranium, and various iron compounds having successively been found effective. Power required to compress the gases may be obtained cheaply from water-gas or from gas producers operating on lignite. Incidentally, it may be mentioned that electrical energy thus produced has been used extensively in Germany to make calcium cyanamide, the output of which has been increased considerably during the war.

Fixation of Nitrogen in Metallic Compounds.—Within the last quarter of a century the electric furnace has shown that the apparent inertness of nitrogen is simply a question of temperature, and that, at suitable temperatures, nitrogen is comparatively active. Even at normal temperatures, certain micro-organisms are able to fix atmospheric nitrogen, but the means whereby they do so is not yet known. The only metallic compounds of nitrogen which have yet found industrial applications are those with the carbides of alkaline-earths and with aluminium.

Calcium Cyanamide, frequently (but erroneously) called simply cyanamide, is produced by the action of nitrogen on calcium carbide. Cyanamide itself, or its calcium salt, is transformed easily into urea, and so into ammonium carbonate. Cyanamide manufacture thus constitutes an indirect synthesis of ammonium carbonate. The special electric furnace used for cyanamide manufacture at the Odda works comprises a large iron cylinder with a double bottom and a detachable cover. The false bottom is perforated with holes, through which the nitrogen enters. Axially in the

furnace there is placed a long carbon pencil connected to the terminals of an alternator, and surrounded by a paper sheath. The charge of carbide, amounting possibly to 1,000 lb., is in successive layers separated by sheets of paper. When the central rod is heated by the passage of current, a temperature of 800 to 1,000° C. is attained along the axis, and nitrogen is then passed into the furnace. The action is completed in 25 to 30 hours.

In determining the electrical energy needed to fix nitrogen by the above method, it is necessary to allow for that consumed in producing calcium carbide. About 4 lb. of carbide is needed to fix 1 lb. of nitrogen, and 1 H.P.-year yields 3,300 lb. of carbide, hence 1 lb. of nitrogen requires 4/3,300 H.P.-year in respect of carbide. The energy requirements of the calcium cyanamide furnace are very low, and 1 H.P.-year is sufficient to fix at least 5,500 lb. of nitrogen, so that the total energy consumption is (4/3,300) + (1/5,500) = 0·0014 H.P.-year per lb. of nitrogen—*i.e.*, 1 KW.-year fixes about 970 lb. of nitrogen. This corresponds to nearly four times the efficiency realised in arc furnaces; but the cyanamide process requires carbon (coke, anthracite, or wood charcoal), which is a compensating disadvantage in some countries.

As it leaves the furnace, the cyanamide contains barely 60 per cent. of $CaCN_2$, the principal impurities being 18 per cent. of free lime and 12 per cent. of carbon. The nitrogen content is 20·5 to 21 per cent. Before the war, the principal, if not the only, use of cyanamide was as a manure, and its use will doubtless extend, although nitrates seem to be of higher manurial value. The latter varies with the conditions of test, but Gerlach gives the following figures:—

	Nitrogen content. Gerlach. Per cent.	Nitrogen content. Scott. Per cent.	Relative value as manure. Gerlach. Per cent.
Sodium nitrate (Chile) ...	15	15½	100
Ammonium sulphate ...	21	18	89
Calcium cyanamide... ...	20—21	13	76
Calcium nitrate	13	18	99
Ammonium nitrate... ...	—	35	—
Farmyard liquid manure ...	—	—	64

When heated with water under pressure, cyanamide yields calcium carbonate and ammonia.* The yield of ammonia is 96 per cent. or more of the theoretical value, and the ammonia may be converted to sulphate (in a purer state than obtainable by distilling coal); or it may be combined with acid to yield ammonium nitrate, which, as shown by the above table, has a very high nitrogen content, and is therefore an economical form in which to transport combined nitrogen. If desired, the ammonia may be converted to nitric acid by the Ostwald catalytic process. The Haber process yields ammonia of higher purity at yet lower cost, and high purity is an important consideration in the catalytic oxidisation of ammonia to nitric acid; but the Haber process is not likely entirely to supplant the cyanamide process, because the latter yields a number of nitrogenous compounds of growing importance.

The first cyanamide works date from 1909, but the world's production was 140,000 tons in 1911, 266,000 tons in 1913, and about 1 million tons at present (corresponding to 1,250,000 tons of Chile nitrate). German production (60,000 tons in 1913) is now about 400,000 tons per annum, and it is due to cyanamide and the Haber process that Germany has been able to dispense with 800,000 tons per annum of Chile nitrate, one quarter of which was used by industry and the remainder for agriculture. Early in the war the German Government placed £7,500,000 at the disposal of cyanamide works† and of the B.A.S.F.; as a result of this munificent grant, the supply of nitrates for explosives and agriculture has been assured.

The Serpek Process.—The B.A.S.F. has patented the manufacture of such compounds as TiN_4, Si_3N_4, but has derived no practical application therefrom. The Société des Nitrures (Paris), however, has developed the Serpek process whereby Al_2N_3 is made by heating bauxite and carbon in the presence of nitrogen. Under the action of high-pressure steam, Al_2N_3 yields pure alumina (useful in aluminium manufacture) and ammonia, which may be regarded as a valuable by-product. The first industrial plant utilising this process consisted of two rotary-tube furnaces, in the first of which bauxite was dried, whilst in the second the dried bauxite mixed with carbon formed a resistance element between two carbon rings, and was thus heated electrically, in the presence of nitrogen. The first furnaces were of 3,000 to 5,000 KW. rating, but 500-KW. furnaces are now considered preferable. It is estimated that 1 KW.-year yields 2 tons of pure alumina and 1,100 lb. of nitrogen in the form of ammonia. The Serpek process seems to be capable of great development, and further details concerning it are given in *Génie Civil* (*loc. cit.*).

Oxidisation of Ammonia.—This is a chemical process dictated by the commercial consideration that nitrogen is worth more as nitric acid than as ammonia. Also nitric acid is a primary material in the manufacture of explosives. Ammonia and atmospheric oxygen interact to yield nitric acid when they are passed over spongy platinum. The true action is complicated, but the apparatus is simple. Various refinements have been introduced, but essentially Ostwald's apparatus is retained. Nearly 100 per cent. efficiency of conversion is obtained, the principal requirements being pure ammonia, such as is yielded by the Haber process.

(To be continued.)

* Details of the process are given in *Génie Civil*, pp. 370-371.

† Bayerische Stickstoffwerke, Trostberg (Franck-Caro process); A.G. für Stickstoffdünger, Knapsack und Mitteldeutschen Stickstoffwerke, Gross Kayna (Polzenius process).

MAGNETIC TESTING FOR STEEL PRODUCTS.

A NEW method of testing steel and steel articles without damaging them in any way was described recently before the American Society for Testing Materials, and is, we understand, to form the subject of a forthcoming bulletin of the Bureau of Standards. The method in question consists of simple magnetic tests, and is based upon the fact that the magnetic and mechanical properties of a certain grade of steel are definitely co-related, so that one may be taken as a criterion of the other. Mechanical tests, chemical analyses, and microscopic examinations of steel are all useful, but none of them can be applied to the actual piece or part which is to be used in service. Mechanical, chemical and microscopic tests are vicarious; they relate only to a small part (sometimes a *very* small part) of a specimen which is assumed to be representative of the service piece or pieces, and the results of such tests are frequently no more than comparative. Magnetic tests, on the other hand, can be applied to the actual pieces to be used in service, they can be applied to the whole length of a steel rail or to the working tip of a tool, and their results can be interpreted definitely, after establishing the magnetic characteristics of what is known to be a satisfactory sample, by a preliminary series of tests.

The first step in evolving magnetic tests to be applied to steel or steel products on an industrial scale is to determine magnetic data for good, bad, and indifferent samples, and thence to derive a scale of equivalence between magnetic data and whatever qualities it is desired to assess in the material under examination. The best magnetic criteria to be adopted in individual cases must be determined by trial, and apparatus must be designed to suit the work pieces handled and the tests made thereon. An important point is to arrange the tests and apparatus so that a minimum of skilled attention is required. The tests can and should be reduced to routine.

As typical of the kind of relation which it is desired to establish (naturally on a definite numerical basis in individual cases), it may be mentioned that the greater hardness and tensile strength and the reduced toughness following upon increased carbon content in steel are accompanied by increased coercive force and hysteresis and decreased permeability. Similarly, cold-drawing of carbon steel increases its tensile strength and simultaneously increases the coercivity and hysteresis, whilst reducing permeability. Heat treatment, the lapse of time ("ageing"), and previous mechanical treatment, all produce corresponding changes in the mechanical and magnetic properties of steels, and it is possible to determine, once for all, the numerical relation between these changes for each particular steel.

The great advantage of magnetic testing in the present connection is that it can be applied quickly (where suitable apparatus is designed for repetition tests) to actual pieces which it is intended to use—even to pieces in service (*e.g.*, bridge members, mine-shaft cables, &c.). Another advantage of magnetic testing is that it indicates variations in mechanical state, chemical composition, heat treatment, &c., whether purely local or whether in the piece as a whole. Of course, the number of variables capable of affecting the magnetic properties necessitates systematic and well-devised interpretation of the latter, but there are no serious difficulties. A simple variation-in-leakage test permits a steel rail to be tested for uniformity in one minute or so. An induction test, using some form of permeameter, then discloses unsuitable chemical composition and bad heat treatment (such as unsuitable finishing temperature or too rapid cooling). Measurements of coercive force reveal differences in quenching temperature as accurately as pyrometer readings.

Raw materials may be tested rapidly and with certainty by magnetic means. The quality of finished products may be checked in the same way, and it may be ensured that samples, whether of material or of products, are really representative. The consequences of not detecting a faulty sample until a destruction or service test is reached may be far-reaching. The possibility of testing actual service pieces without injuring them in any way permits of more economical design with a lower initial factor of safety, and the possibility of testing parts whilst in service permits them to be used until the lowest permissible factor of safety is reached. To cite only a single example, steel ropes for hoisting or winding may be kept much longer in service when a reliable means is available for observing continuously their deterioration. Individual testing of all parts or pieces permits of grading, and, by eliminating uncertainty as to quality, prevents wasteful expenditure of material and quality, and attaches higher value to the latter where really required, since it can now be guaranteed with greater certainty.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Disconnectors and Gate-End Boxes.

Messrs. George Ellison, of Wellhead Lane Works, Perry Ba ; Birmingham, have recently introduced a line of "disconnectors" for A.C. and D.C. circuits up to 720 volts. These are intended for isolating sub-sections of works installations, branch cables and motors, during alterations or repairs, and being "isolators" only are not intended to be operated when currents are flowing. They can be bolted to walls or installed in cable trenches and manholes. Two sizes, triple-pole, for cables of ·125 and ·24 sq. in. section, are made; by omitting one pole a double-pole pattern is obtained.

The contacts of the two sizes will carry 125 amp. and 240 amp. with 35° F. temperature rise.

Fig. 1 shows a disconnector with the case closed; fig. 2 shows

Fig. 1.—Ellison Disconnector, Closed.

the switch interior removed. The arrangement consists of a circular c.i. box built up in three sections, and provided with four flanges for radial cable fittings.

The mechanism and contacts are supported on the base casting only; the fixed contacts are round copper rods with tapered ends, while the moving contacts are brass blocks with circular recesses or chambers containing rings made of phosphor-bronze spiral springs, which the plugs force against the sides of the recesses, giving an intimate elastic self-cleaning contact between plug and block. A cast-iron partition under the handle entirely encloses all live parts, and the whole moving system can be withdrawn from the box without the risk of accidental contact with live parts.

Fig. 3 shows another of Messrs Ellison's specialities, viz. an oil break gate-end box with trailing cable socket and plug inserted, the breaker being closed. The makers point out that instead of using long and heavy trailing cables to remote positions it is better to install plug sockets, with a protecting switch or circuit breaker at suitable intervals.

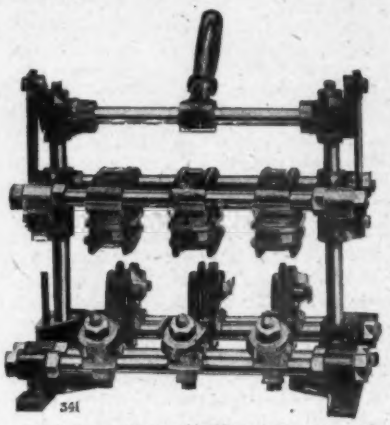

Fig. 2.—Switch Interior Removed from Box.

The fittings have been designed to combine an oil circuit-breaker interlock and socket and plug in one unit, with special application as gate-end boxes for the trailing cables of coal cutters. One size of 100-amp. capacity is made in double and triple-pole patterns for use with standard oil circuit-breakers.

For the double-pole pattern, a three point socket and a plug are mounted on a dividing box bolted to a D.P. breaker, and the plug cannot be removed until the breaker is off. In the triple-pole

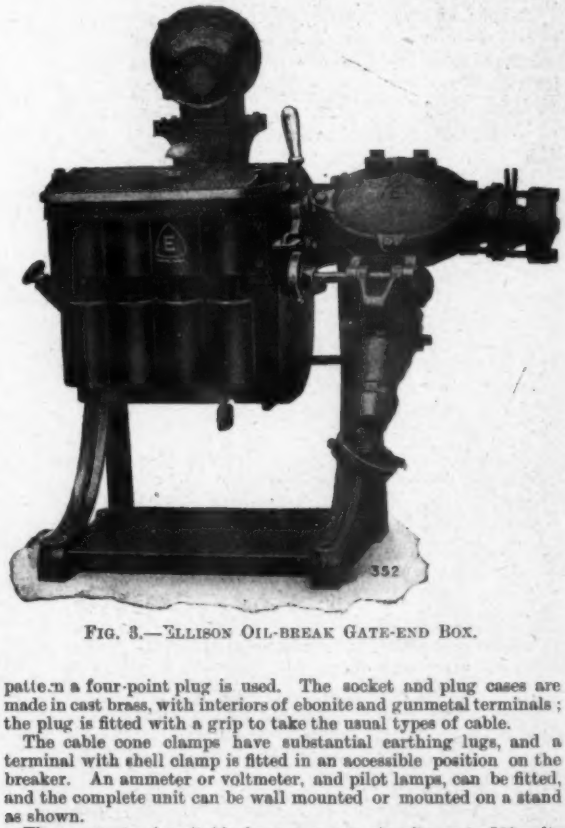

Fig. 3.—Ellison Oil-break Gate-end Box.

pattern a four-point plug is used. The socket and plug cases are made in cast brass, with interiors of ebonite and gunmetal terminals; the plug is fitted with a grip to take the usual types of cable.

The cable cone clamps have substantial earthing lugs, and a terminal with shell clamp is fitted in an accessible position on the breaker. An ammeter or voltmeter, and pilot lamps, can be fitted, and the complete unit can be wall mounted or mounted on a stand as shown.

The apparatus is suitable for A.C. or D.C. circuits up to 750 volts pressure.

Stoll's Cable Fault-finding Apparatus.

Finding faults in cable core at the earliest possible stage of manufacture will be admitted by makers to be a most desirable achievement. From the boy holding a wet cloth on the cable and receiving a shock when a faulty portion passed through it, to the more humane if less exciting use of a galvanometer, battery, and water bath, was not a long step, nor was the result all that could

be desired, for high-resistance faults still escaped detection, and the process could not be applied to cables at all stages of manufacture. The development of a successful "spark" method of testing, therefore, by Messrs. Norman, Stell & Co., of 23, Spring Gardens Road, Heaton, Bradford, will be welcomed by the trade. We understand that the apparatus has been at work successfully for some 12 months, 10 hours or more daily, and has proved its worth; it is illustrated in fig. 4 herewith. In the makers' words, the method consists of using a high-potential and high-frequency discharge or spark to indicate a fault, the conductor of the cable being connected to one terminal or earth, while the cable itself runs through the hand-clip provided, which is connected to the H.T. terminal by means of flexible leads.

The apparatus comprises an induction coil controlled by specially arranged instruments, the energy being derived from any commercial D.C. or A.C. lighting supply, and the makers have arranged, for general work, a "Standard" apparatus fitted for four sets of fault-finding, each separately controlled; 20 ranges of regulation are provided. It is arranged for connecting to any B.C. lampholder or wall plug (two-pin), and being fitted (excepting leads and clips)

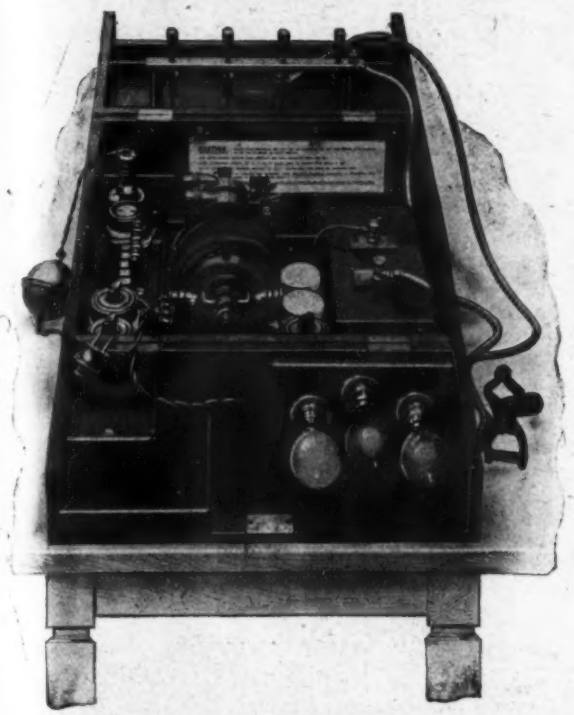

Fig. 4.—Stell's Fault-finding Apparatus.

in a polished wood case, it is easily portable and can be used in any convenient position.

The makers claim the following advantages for their method and apparatus:—

The cables may be kept perfectly dry, so that repairs can be better and more easily made.

Cores can be examined before vulcanisation, thus obviating the separate curing of repairs.

Finished wires or cables which would be damaged by water or dampness can be easily "fault-found."

No batteries or tremblers are used, and consequently the detecting spark remains constant, thus eliminating expensive renewals.

Faults of comparatively high resistance (say, 200 megohms) are easily detected, hence the customary "breaking down" of faults—which is often damaging to the cable—is avoided.

There is no danger to the operators, provided the simple caution given with sets is observed.

The current consumption is exceedingly small, and a "short" on the primary or secondary of the coil will not cause any damage.

The wear and tear is exceedingly small.

No special skill is required to use the apparatus or keep it in working order, there being no intricate or delicate parts.

The spark, being static, does not damage the insulation as an ordinary A.C. high-tension current sometimes does.

The spark can be both seen and heard.

Finished flexibles and P.R. insulated cables can be examined for faults.

Cables and cores can be easily fault-found wet if proper precautions are taken—viz., the usual insulation of the conductor from the drum spindle and the outside of cable or core.

Messrs. Thompson & Co., 48, Watling Street, E.C. 4, are the London agents for the makers.

The New C.A.V. Electric Starter.

The accompanying illustrations, fig. 5, show the initial and final positions of the pinion of the C.A.V. starter, which we described on page 305 of our issue of September 28th. In the first position the screw thread is visible, which, when the motor is set in slow motion, with the pinion drawn into contact with the gear on the flywheel, brings the pinion fully into gear as in the second view. By using a two-position plunger, which allows the pinion to mesh with the gear wheel at a low speed, before the full power of the motor is

Fig. 5.—The C.A.V. Starter, Disengaged and Fully Meshed.

exerted, the sudden impulse which is applied to the flywheel by some American types of starter is avoided, and there is no danger of breaking the engine shaft. The screw also ensures with certainty the disengagement of the pinion without damage to any part of the mechanism in the case of a backfire.

We are informed that owing to the great public interest taken in the new starter and the wide publicity it has received, the firm have found it impossible to cope with all the demands for booklets, drawings &c., but inquiries are being dealt with as rapidly as possible.

THE ENGINEERING PLANT IN LARGE HOTELS.

Speaking on this subject at University College, London, last week, at a public introductory lecture in association with the Sub-Department of Heating and Ventilating Engineering, Mr. A. H. Barker, B.A., B.Sc., Whit.Sch., said the organisation of a large modern hotel was an affair of considerable complication. It must be prepared not only to supply the requirements of a thousand persons at all times, but at any moment for the unexpected arrival of a hundred new visitors at a time. Such an event should hardly cause any stir or confusion, but merely somewhat harder work on the part of the staff. Things were done for the individual guest to all appearance so automatically, that he never even thought of the organisation and engineering plant involved. It was the labour-saving devices which constituted the engineering equipment which enabled it to be done; it could not be done without these apparatus. The application of such apparatus on a small scale to a private house would greatly reduce the labour necessary. It must also be remembered that no part of this great mass of machinery was visible to the guests in an ordinary hotel except the lift cages and the taps. The bulky parts of the plant were all disposed of either in the sub-basement, which was one mass of machinery over almost the whole area, or at the top of the building. A large hotel was not constructed until a very great amount of thought had been expended upon it; its construction was so complicated that it would be inviting disaster to commence operations before the whole of the details had been exhaustively thought out. In the case of some large hotels in which he had been interested, every motor, fan, and other piece of machinery, every pipe and flue, had been on the plans, and the whole of the calculations had been completed even before the buildings, which were to be destroyed in order to make room for the future hotel, had been demolished. A particular example of this kind was very complicated. The hotel was practically cut in two by a railway which passed right through it; only one set of boilers was admissible, so that the supply of steam had to be carried across the railway to all parts of the building. Similarly, fresh air for ventilation could only be taken from one portion of the site, and distributed from this to every part of the building, and the same was true also of other services.

In the boiler-house and heater-room all the heat required for every service except the direct fire cooking was generated. The cost of the fuel in an hotel was a very serious item, amounting in some cases to tens of thousands of pounds per annum. It was easy to see that facility of control was one of the most important features in the design. It was necessary that it should be perfectly easy not only to know what the requirements at any given time were, but to adjust them according to requirements with very little trouble. It was, therefore, in the first place desirable to provide that all such operations could be carried out from one point in the hotel.

In the buildings for which he had been responsible this had been arranged to be done from one centre which he had termed the "control room," in which were concentrated electrical and mechanical appliances for enabling the control to be exercised at distant points without the engineer-in-charge leaving the control room. One of the principal difficulties in arranging all the mass of machinery in an hotel was to provide against noise, particularly in a modern hotel constructed of steel girders and concrete, which transmitted noises from the basement to the upper floors with great ease. The noisier machines had to be placed outside the buildings. It was necessary in all cases to bed the motors on sound-absorbing foundations, such as cork, or felt, or hair mattresses. Many of the operations necessary in a modern hotel continued throughout the night, and in one of the big areas or courtyards of an hotel, surrounded on all sides by bedroom windows, most of which were open, the least noise was apt to be magnified in the stillness of the night, and to become a ground for complaint.

WAR ITEMS.

Exports to China.—The "London Gazette" for October 16th contains further names of persons in China and Siam to whom exports may be consigned.

Belgian Reconstruction.—It is stated that M. Paul Hymans, the Belgian Minister, has been called upon by his Government to take up the direction of a new Ministerial Department specially entrusted with all questions concerning the economic reconstruction and the commercial policy of Belgium.

Trading with the Enemy.—The "London Gazette" for October 12th contains further lists of persons and bodies with whom trading is prohibited in the following countries:—Argentina, Paraguay, Uruguay, Bolivia, Chile, Netherlands, Netherlands East Indies, Norway, Peru, Spain, Sweden, and Venezuela. Variations in and removals from previous lists are also given.

Raw Materials After the War.—Dr. Addison, the Minister of Reconstruction, after consultation with the other Government Departments concerned, has appointed a Committee to consider and report upon questions connected with the supplies of raw materials which will be required by British industries for the purpose of restoring and developing trade after the termination of the war, and the best means of securing and distributing supplies, due regard being had to the interests of the Allies. The Committee is requested, in regard to any commodities which might not be available in sufficient quantities and at reasonable prices through the ordinary commercial channels, to consult members of the trades concerned with regard to any steps that may be necessary to safeguard the needs of industry, and to secure convenient and equitable distribution. The Committee, which will be known as the Central Committee on Supplies of Materials, consists of the following:—Sir Clarendon Hyde (chairman), Sir Henry Birchenough, K.C.M.G., Mr. Cecil Budd, Sir Charles W. Fielding, K.B.E., Sir H. Babington Smith, K.C.B., Mr. Wallace Thorneycroft, and Mr. Andrew Weir. The Secretary is Mr. J. F. Ronca (Board of Trade), communications to whom should be addressed at the Ministry of Reconstruction, 2, Queen Anne's Gate Buildings, Westminster, S.W.1.

Commerce and Demobilisation.—According to the *Financier*, the Council of the London Chamber of Commerce has referred the question of reconstruction as affecting industry and trade to the trade sections concerned, with a view to the formulation of a definite policy in the interests of manufacturers and merchants. It has referred to a special committee to report as to the desirability of the early release from military service, after the war, of men in commercial occupations, including principals, partners, clerks, and technical experts, whose places have been kept open for them or whose services will be urgently required after the war. Arrangements were also agreed upon for a public meeting of merchants and others on the question of Government control of trade.

Recruiting in Munitions Areas.—Defence of the Realm Regulation 41AA, which came into effect on August 8th, 1917, requires employers to whom it applies to notify the Munitions Area Recruiting Officer within 48 hours when a man enters or leaves their employment who holds a certificate issued by any Munitions Area Recruiting Officer. This Regulation has been made in order to secure that the records in the Recruiting Register of men who hold certificates protecting them from recruitment because they are engaged on Admiralty, War Office, or munitions work, are kept up to date. The Scheduled Occupation Certificates and the Protection Certificates issued under the Schedule of Protected Occupations are only valid so long as the holder is engaged on Admiralty, War Office, or munitions work, though, as explained below, men will not forfeit protection from recruitment merely because they are moving from one firm engaged on such work to another. It is necessary, in the interests of all concerned in the output of ships and munitions of war, and in recruitment for the Army that the value of these certificates should not be impaired through their retention by men who have ceased to be entitled to hold them. It is not intended that this Regulation should in any way interfere with the individual workmen's freedom to change his employment, which is restored now that the abolition of leaving certificates under the Munitions of War Amendment Act, 1917, takes effect. On the other hand, it is not reasonable that protection from recruitment, which is given solely on the ground that a man is more usefully employed on necessary war work than he would be in the Army, should be abused by protracted absence from work. Accordingly instructions have been given to Munitions Area Recruiting Officers that after 14 days from the date of leaving they should call up any man who has left his employment, if by that date no notification has been received of his re-employment on work which entitles him to continued protection. In view of the urgent demand for labour of the kind protected under the Schedule, it is considered that a fortnight is ample time to allow for workmen to obtain fresh employment. If by the end of 14 days a man is still not employed on work entitling him to protection, he becomes liable to recruitment, unless he can prove to the Enlistment Complaints Committee that his failure to obtain work was due to sickness or to a definite cause entirely beyond his control, such as the temporary closing of a shop where he has secured employment. The period of 14 days runs from the date when the workman actually leaves his employment, whether he leaves on the week's notice or termination of employment provided for under the Munitions of War Amendment Act, 1917, Section 3 (1), or otherwise. It is the duty of any man holding a Scheduled Occupation Certificate, Army Form W.3476A, who changes his employment or his address, to take or send his certificate to the nearest Recruiting Office, in order that the change may be duly recorded in the Military Register.

Exemption Applications.—At Rochdale, temporary exemption to February 28th was given to F. Walton, 29, married, an overhead linesman in the Corporation tramways department. He was now C2, formerly Class A, and Mr. G. Webster, the manager, said the man had been discharged from the Army.

At St. Annes-on-Sea, when two motormen, each C2, were exempted to the end of March, it was stated by Mr. H. W. Laing, manager of the Blackpool, St. Annes & Lytham Tramway Co., that some 160 men in the company's service had joined the Forces, and there were now only eight of the original staff left.

At the West Riding Appeal Tribunal, a Leeds tramdriver, aged 42, Class A, who pleaded domestic hardship owing to the illness of his wife, said he was also in a certified occupation. He had been a driver continuously for 14 years, but it was said the Corporation were prepared to release him. Discharged soldiers were being substituted. The appeal was dismissed, applicant to report in a month.

At the same Tribunal, the storekeeper of a Leeds cable company, aged 39 and Class C1, said that his firm were doing Government work, and he was better employed than in the Army. The case was dismissed.

At Farsley, Norman Hill (29), C3, secretary of the Morley Electrical Engineering Co., had his exemption extended till December 31st.

At the same Tribunal, C. W. Broadbent (32, C1), fitter; F. B. Wheatley (36), tool fitter; and F. Strickland, ripping machinist, all employed by the Phœnix Dynamo Co., Ltd., Bradford, were informed that, being in possession of trade cards, there was no further need for them to appeal, but should the cards be withdrawn they must lodge appeals within seven days, or otherwise they would be soldiers.

Before the Herts. Appeal Court, exemption was sought by M. J. Connari (38, B2), electrician, Watford. The Military Representative said that it had been decided twice by the Local Tribunal and once by the County Appeal Court that appellant had no claim on business grounds. The Court heard the claim on the one-man business plea, but dismissed it, with grace until November 15th.

At Reading, an appeal was made by J. H. Ferguson (36, C3), director and secretary of the Whitchurch and Pangbourne Electric Supply Co., Ltd., and said to be practically the only person now running the concern. Sir Cameron Gill, for the Military, claimed appellant as being useful for the Army Pay Corps. Three months were conceded.

Before the Horsham Rural Tribunal, exemption was claimed for the man in charge of the electric lighting plant on the Lower Beeding Estate (30, B2). The man desires to join up, and time in which to find a substitute was asked for. The Tribunal suspended the calling up for five weeks.

Maidstone Tribunal has granted six months' conditional exemption to H. Clement (37, C3), electrical engineer at the Allington pumping station.

Dover Tribunal has granted a further three months' exemption to A. E. Overs (33, C1), electrician at the King's Hall.

On the appeal of Messrs. J. Walsh Ltd., exemption until April 11th has been granted at Sheffield to L. Fryer (B1), electrical engineer.

A month's exemption has been allowed to T. W. Johnson, electrical engineer at the Stansted (Essex) sewage works.

On the appeal of the City Council, the Chester Tribunal has granted four months' exemption to the tramways super-

intendent, and conditional exemption to a driver (C 2) and a coachbuilder (41, B 1).

An electrical engineer and contractor (31, B 1), who appealed at Newcastle-under-Lyme, has been given exemption until the end of the year.

At Rochdale, exemption was claimed by W. Pickard (30, B 2), electrical engineer, previously rejected, and now engaged in making experiments. He was given until January 31st.

At Swinton and Pendlebury, Messrs. Ermin & Roby appealed for their electrical engineer (38), and temporary exemption until December 31st was granted.

Brighton Tribunal has granted three months' exemption to an electrical contractor (29, C 3).

At Leicester, appeals were made by two partners in a firm of electrical engineers, one in C 1 and the other in C 3. It was stated that the firm's turnover was £4,000 per annum, and that they were doing a great amount of work for local engineering firms. The C 3 appellant was allowed four months' exemption, and the other appeal was adjourned.

The East Kent Appeal Tribunal has allowed a Military appeal against the refusal of the Broadstairs Tribunal to withdraw conditional exemption held by the chief storekeeper of electrical plant in the employ of the Isle of Thanet Tramway Co. The man is not to be called up before January 8th.

An appeal was made at Maidstone for J. H. Baxter (31, passed for general service), electrician at the mills of Messrs. Reed, Tovil. The firm was willing to accept a substitute, and exemption was granted until a suitable one is found.

On the appeal of the Electric Tramways Co., the Oxford Tribunal has granted three months' temporary exemption to A. W. Oakley (37, C 3), blacksmith's fitter.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Curiosities of Early Mains Work.

In your issue of September 20th I read with considerable interest the article by Mr. G. W. Stubbings under the above heading. In it, he refers to "a system of distribution recently proposed in which the live main is looped into each consumer's premises in order that the distributor may be sectionised." I presume that the system he mentions is Patent No. 12,105/15, by Messrs. Callenders & Frampton. If this is the case, I think he cannot have given the system very careful consideration. His sole objection to it seems to be on the score of expense, and he quotes, as an example, the cost of a service 20 yards long. In the first place, in most provincial towns where distributors are laid on both sides of the streets, a consumer's cut-outs are very rarely 20, or even 10, yards from the main. Then, it is not proposed, I believe, to install a sectionising device in every consumer's premises: it would obviously be absurd to install one in a main street where practically every shop is connected; but to have two or three in each street would simplify fault localisation considerably, and what is of greater importance, would admit of the majority of the consumers' supplies being got on almost immediately (I am referring, of course, to a street being fed from both ends). These sectionising devices, moreover, would act as disconnecting boxes, thereby saving the cost of boxes, bush chambers, path frames, and covers, &c. The only expense entailed is in the cable, and this can be ordinary three-core with a small middle wire (in a three-wire D.C. supply), and two cores the same size as the main. The cut-out need only be a very simple affair, and can be made by anybody from odds and ends which are always lying about in the works. The extra labour is almost negligible. The system is quite capable of obviating a tremendous lot of mains trouble, and if Mr. Stubbings goes carefully into it I think he will admit that any slight extra cost is very easily balanced by the ease and simplicity of localising the fault and re-establishing the supply.

A. E. Baker,
R.F.C., B.E.F., France.

October 7th, 1917.

The Prospects of the Central-Station Engineer.

In your footnote to the letter of "Staff Electrician," in your copy of September 28th, you say:—"Under existing circumstances we cannot recommend young men of ability and ambition to join the staffs of power stations, unless it be for the purpose of acquiring a first-hand knowledge of the organisation and working conditions of such stations as part of their technical training, and not as a career."

Now, Sirs, if your advice is to be taken at its face value, it discloses a most serious and lamentable state of affairs—or, should I say, state of mind?

The generation, distribution, and utilisation of electricity, you will admit, is of *some* importance in the national life, even at this date, and yet it is but on the threshold of its fuller development and possibilities.

"Existing circumstances," admittedly, are not all that are desirable. They are the result of lack of foresight and imagination in the early days, of the English genius for muddle, and of selfishness. That is in the past.

Are existing circumstances to become permanent? They can't. They must improve or deteriorate. Surely there must be something better to look forward to and to work for?

But a way to help forward is not to advise young men of ability and other desirable characteristics to shun us. It appears to me that this advice savours of rank disloyalty to those of ability and ambition already in the profession, whose ambition is not alone of the personal variety, but who have the fuller development of their chosen work in life ever before them; and there are such men, I beg to inform you.

Young men of ability and ambition are sorely wanted; never so much before as at this time—would you assert that an influx of "duds" is desirable, or is calculated to fit the profession to face the immense possibilities opening out before it?

Come, Sirs! Not a small percentage of your readers are numbered amongst us in the central-station side of the profession, and we look for an exhibition of truer logic on your part than is revealed in your advice as above set out. Admit that your criminal pessimism was an after-effect of some Hunnish raid!

John A. Vice.

Manchester, *October 4th*, 1917.

[Our correspondent writes an able and interesting letter, with much of which we agree. The subject is one on which a volume could be written, and, therefore, it is difficult in the space available to discuss it adequately; but it is necessary to make our position clear, and to disabuse the minds of Mr. Vice and his central-station colleagues with regard to our loyalty to their profession—though, in view of the efforts we have made during many years to improve their salaries and status, this should be a superfluous task! We fully realise the increasing importance of electricity supply, and are doing all that we can to accelerate its reorganisation on more efficient and economical lines; there will in the future be some very desirable appointments to be filled in this branch of the industry, and many more that can be described as comfortable. It is true in this calling, as in others, that there is always room at the top. But there is vastly more room in the lower grades of employment, in which the salaries are low, the work is monotonous and unvarying, the duties involve attendance seven days a week, and the prospects of advancement are poor. For proof of these facts, though he must be aware of them, we refer our correspondent to the articles on "Wages and Holidays in Central Stations" in our issue of February 23th, 1913; "Salaries in Municipal Undertakings," April 11th, 1913; "The Position of the Shift Engineer after the War," January 12th, 1917, and the letter of "Ex-Shifty" in the following issue; and "Staff Organisation in Electricity Supply Undertakings," July 13th, 1917. These articles represent the "*existing circumstances*" to which we explicitly referred, and which our correspondent admits are "not all that is desirable"—a mild expression. He says: "That is in the past." Unfortunately, it is also in the present, and that is the reason why we cannot recommend any young man of ability and ambition to enter a power station with the intention of remaining in the business.

We fervently hope that the conditions will be changed in the future. We do not find fault with the able men who are engaged in electricity supply, nor do we reflect upon them in any way; but we sympathise with them as, in the main, a class of men who render valuable services to the community under conditions of work and remuneration which are a disgrace to the country.—EDS. ELEC. REV.]

The E.T.U. and the A.E.S.E.

I observe in Friday's, October 13th, issue that your correspondent, signing himself "Shift Engineer," states that there is no organisation in the provinces for dealing with shift engineers. I would point out that this Society has over 160 branches throughout Great Britain and Ireland, and seven special station engineers' branches, all of which cater for this and all station electrical grades. I shall be glad to supply him with full particulars, or he can obtain them direct by writing to our general office at 137, Great Clowes Street, Manchester.

H. H. Morton,
Secretary, Electrical Trades Union,
London Station Engineers, No. 1 Branch.

London, *October 13th*, 1917.

Anonymous advocacy carries no conviction, and adds no weight to discussions; we may therefore direct ourselves to the only signed letter on this topic in the columns of the last issue of your journal.

Ruling out the advertising matter in that letter, the remainder stands as an indictment of A.E.S.E. inactivity. This entirely misses the mark, and it would be well if your interested readers realised the following facts:—

This movement amongst station engineers does not arise

out of "A.E.S.E. tactics," but out of "E.T.U. tactics," and has been independent of any organisation.

The pioneers of the A.E.S.E. were central-station engineers, and its present constitution is that of central-station engineers.

Logical sequence: Individual aims merged in the common desire for a body representative of central-station engineers, which is now the A.E.S.E.

That is the only fact that matters, and all discussion surrounding A.E.S.E. inactivity and its past, or E.T.U. activity and its future, is superficial and futile.

The term "democratic" creeps into Mr. Barnes's letter. As a trade unionist he should be amongst the first to recognise that democracy clearly defines the right of every section to voice its own opinions. To assert that "an effective organisation will not tolerate interference" is hardly a democratic utterance!

W. Arthur Jones, *Hon. Sec.*
H. W. Healey, *Chairman.*
London Division, A.E.S.E.

Leytonstone, *October 15th*, 1917.

Instructions to Meter Readers.

I have been much interested in your article on "Meter Reading"; throughout, one could see it was from the pen of a practical man. I should like, however, to take exception to the statement of Mr. G. W. Stubbings, who thinks the average man would advise a consumer that his meter was 200 per cent. fast. I should like to ask G.W.S. if he has ever considered it worth while to spend a few minutes with his meter-readers, and give them advice, as these men need training just as much as the men in any other department.

I have known a chief to meet the meter-readers in at night, inquire as to the number read, and talk about the difficulties in a practical way, and advise them generally. The result was that the men saw the importance of the job, it led to a better understanding, and afterwards they tried to carry out as far as possible the engineer's wishes. I can only recall one such interview, but everybody benefited by it. I agree with G.W.S. that meter reading has to be done quickly, and any inspection of apparatus, to be of any value, would be better left to an inspector proper.

A.B., *Meter Inspector.*

October 15th, 1917.

The Association Movement.

Your leading article of the 5th inst. and Mr. Berry's contribution of the 12th serve to focus attention on a subject which is destined to receive even more consideration in the near future.

I hope you will prevail upon Mr. Berry to develop in a later article the plans to which he refers in his concluding paragraphs.

We are all in his debt for his earlier efforts, of which he has given such an interesting account, and his further advice cannot fail to interest many of your readers.

Has he despaired of the Federation of British Industries ever becoming a true federation of *associations* of the type his instinct rightly leads him to desire?

O. N. Looker.

LEGAL.

A Dundalk Prosecution.

At Dundalk Quarter Sessions, before Judge Green, Dominico Mezza, an ice-cream merchant, was found "not guilty" on a charge of fraudulent abstraction of electricity belonging to Dundalk Urban Council. Mr. P. A. Spalding, the Council's electricity engineer, gave evidence in support of the contention that current was being used without going through the meter. To the Judge, witness said he could not state the method used to prevent the current being registered; he could only give the results. He was sure, however, that "a man in the street" could not adopt this method. His Honour told the jury that there was no evidence that Mezza had tampered with the meter or the wires, adding that it was often difficult to trace electrical defects. The verdict mentioned above was returned on the Judge's advice.

Workmen's Compensation Cases.

At Preston County Court, William Greer, a skilled labourer, claimed compensation under the Workmen's Compensation Act from Messrs. Dick, Kerr & Co., Ltd., Preston. The applicant's case was that as the result of an accident whilst starting an electrical machine he developed facial paralysis, which affected his right eye and the right side of his face. The respondents' contention was that the man was suffering from an hysterical affection, and that work, instead of being harmful, might help him. His Honour Judge Sturges, K.C., found for the respondents, but gave no costs.

At Preston County Court on October 9th, James Berry, electrical engineer, of Woodcock's Court, Preston, asked for a review of the compensation agreement, with Thomas Cross, electrician, Fernyhalgh, Preston. The respondent, it was stated, was injured on June 23rd, 1914, by his hand coming into contact with a live wire, charged with a current at 220 volts. As a result of the shock neurasthenia was brought on, and by agreement a sum of £1 a week was paid to him.

The medical evidence given by Dr. Collinson, and Dr. House, Liverpool, was that the respondent was in fair physical condition, and that light outdoor work would be of benefit to him, whilst brooding over his condition was likely to make it worse.

On respondent's behalf, Dr. Mooney and Dr. Warrington, Liverpool, said the man's condition was still so serious that he was unfit for any kind of work.

Respondent, describing the accident, said the amperage was very great as his body was "dead earthed." He was held until the wires melted, probably for a couple of minutes, and was unconscious for four hours afterwards. He still suffered from dizziness, falling in the street, confusion in traffic, and, occasionally, loss of memory. Gardening caused pains in the head, and when he tried to cycle he fell off through dizziness.

Judge Hugh Sturges, K.C., with whom sat Dr. Irvin Sellers as medical referee, remarked that the respondent was what might be termed an "odd lot" in the labour market, and he was not satisfied that the man was capable of doing light work, or that he could obtain such work in the open market. He gave an award for respondent, with costs.

In the Bow County Court, before his Honour Judge Graham, K.C., sitting with Dr. Bate as medical referee, Rosetta Ellen Cooper, of Plaistow, asked for an award, under the Workmen's Compensation Act, against the Western Electric Co., Ltd., of North Woolwich. It appeared that the applicant was employed on a fuse screwing machine, and in the course of using it she had to work a clutch which threw a band on to a wheel to start the machine. This clutch was very stiff, and one day in June of last year, as she went to "strike on," she felt a pain in her inside, and felt sure she must have hurt herself. She became so ill that finally she had to be operated upon in the hospital. In June of this year the respondents offered her light work and declined to pay her any more compensation, this action being the result. Medical evidence was given to the effect that she was quite capable of light work in June, and the Medical Referee advised the Judge to enter judgment for the respondents, with costs.

According to a Cape newspaper just to hand, judgment was recently delivered by Sir John Kotze in the Supreme Court in the appeal of Elias Jacobs *v.* The Cape Town Corporation.

The appellant, who was employed by the Corporation, was injured whilst repairing some electric wires. The accident happened on March 23rd, 1916, and on September 5th Jacobs claimed £150 under the Workmen's Compensation Act. The magistrate granted a provisional order for half-wages at the rate of 15s. 6d. a week, with costs, and this amount the Corporation continued to pay until March 23rd last, when they ceased doing so. On April 30th the appellant served notice on the respondents claiming £117 as half of three years' wages, less £39 paid since the date of the injury. To this the Corporation pleaded in bar that a period of 12 months had expired without Elias having taken any further steps to reopen the matter and pursue his claim for compensation for permanent partial incapacity. This was upheld by the magistrate, who dismissed the application with costs. From this decision Elias appealed.

His Lordship remarked that the magistrate based his ruling upon Sec. 20 of the Act, which, if correct, meant that the applicant lost his right to further compensation. The liability of an employer to make periodical payments under a provisional order granted by a magistrate might stop at the expiration of 12 months from the date of the accident, but that did not in any way establish that the right to apply for a fixed sum by way of compensation had lapsed by the effluxion of time. The Court could not, through a forced construction or strained inference, deprive a person of a right given him by the Act. The appeal would be allowed, with costs, the judgment in the Court below on the plea in bar set aside, and the magistrate directed to hear the application on its merits.

Holt *v.* A.E.G. Electrical Co., Ltd.

In the Chancery Division of the High Courts, on Tuesday, Mr. Justice Younger was asked, on behalf of the plaintiff, to adjourn this action generally, with liberty to restore.

Mr. Galbraith said the plaintiff, who was the central witness, was serving at the Front. The action was on an agreement of service, for a declaration that the defendant company was bound by the agreement, and for damages.

Mr. C. J. Conway, for defendants, said the entire claim rested upon written documents, and the defence was that certain letters were not binding upon the company, and that they were *ultra vires*. If this defence failed, the amount due could be easily found. The defendants said the consent of the Board of Trade had not been obtained, the company being in the hands of a controller. On this point they were anxious to get his Lordship's decision, as there were other cases depending upon it. The case could be heard in the plaintiff's absence without injustice to him.

Mr. Galbraith said the case was started in the Manchester District Registry, and the plaintiff was a material witness. Plaintiff was employed as the commercial manager of the company at their head office in London, and was now a private in the British Army in France. The agreements were traversed, and it was alleged there was no consideration for them.

Mr. Conway said, for the purpose of coming to trial early, he thought he could waive the question of no consideration.

His Lordship said, subject to the question of no consideration being waived, the case would take its ordinary course, when, if it was found necessary to have the plaintiff present, there could be an adjournment. The case, however, could not come on before Monday week.

Wireless Engineer's Action.

Before Mr. Justice Lush, in the King's Bench Division, on Monday, Mr. Whitehead mentioned the case of Elwell against the Universal Radio Syndicate, Ltd., of which, he said, plaintiff's counter-claim was outstanding. Plaintiff applied, as defendant, that the case should stand over till the next sittings. Plaintiff was a distinguished engineer and wireless expert, and the substance of the counter-claim was as to certain contracts he entered into with the British Admiralty and the French Government. The question was whether these were really fraudulent contracts in the sense that they ought to have been entered into with the defendants. The Universal Radio Syndicate was a wireless telegraphic company, in whose employment the plaintiff formerly was. The firm had admitted liability to plaintiff, and had paid money into Court.

Mr. Hogg, K.C., said the case for the syndicate would be that the plaintiff whilst in their employ, without their knowledge, got contracts for his own benefit and put the money in his own pocket.

Mr. Whitehead said Mr. Elwell was, of course, a material witness. He had a letter from the Ministry of French Marine, in which it was stated that he was indispensable in France at the moment. He was engaged in constructing wireless apparatus and wireless stations. Some inventions of his own were being employed.

Mr. Hogg: That there should be some postponement, I think, is clear. But the first application was made on May 7th. It was sworn on May 11th that it was impossible for him to leave France under the contract with the French Government, and the case was ordered to stand out till July 2nd. On June 24th another application was made, again supported by affidavit by Elwell, who then swore that he had a contract with the Italian Government, which would require him to be in Italy for a considerable time. Now an affidavit by a solicitor's clerk stated that he was engaged with the French authorities, and they were told that the Inspector-General charged with work of naval construction certified that the presence of Elwell was indispensable upon the works. He suggested that the matter stand over for a month.

His Lordship said he thought Mr. Elwell should make application to the authorities in France for leave to come over any time the authorities chose to fix.

Mr. Hogg said his company desired to be wound up, and wanted its money paid out of Court if it was entitled to it.

Mr. Justice Lush said his Order would be as he had indicated, and the costs of the application would go to the syndicate.

BUSINESS NOTES.

Dissolutions and Liquidations.—British Continental Electricity Co., Ltd.—This company is winding up voluntarily, with Mr. C. E. Barker, 21, Finsbury Pavement, E.C. 2, as liquidator.

Universal Telephone and Electrical Co., Ltd.—A meeting is called for November 13th, at 6, Old Jewry, E.C. 2, to hear an account of the winding up from the liquidator, Mr. J. E. Percival.

Schall & Schall, electrical engineers, 71-75, Cavendish Street, London.—Mr. Karl Friedrich Schall has retired from the partnership. Mr. W. E. Schall will attend to debts, &c., and will alone carry on the business as Schall & Son.

Akroyd & Marsland, tool and gauge manufacturers, Halifax.—Messrs. F. F. Ackroyd & J. Marsland have dissolved partnership. Mr. Marsland attends to debts, &c.

Developments in Japan.—The British Vice-Consul at Tokio, in a recent report on the formation of new industrial enterprises in Japan since the outbreak of war, states that the chemical industry takes first place in recent developments. In metals, metal goods, machinery and textiles there have been great developments. In regard to electrical supplies and accessories, during the period reviewed by the Consul, six Japanese companies have been organised for the manufacture of electrical supplies and accessories, such as electric motors, dynamos, switches, lamp bulbs, carbon electrodes, carbon brushes, &c. An improved process for the manufacture of micanite has enabled a Japanese company to turn out insulators, both for the home and the export trade. The total combined capital of the six companies referred to amounts to 4,530,000 yen, and they operate 11 factories.

A Westinghouse Works Committee.—There has been formed at the works of the British Westinghouse Co., Ltd., at Trafford Park, a Works Committee, representing both the firm and the employés, which deals with a variety of matters affecting the welfare of the workpeople. The Committee consists of 14 members in all, one from each section of the works, and two representing the firm, and meetings are held each Monday afternoon. Questions of ventilation, provision of tea canteens, purchasing overalls at cost price, securing cheap tickets for workmen to travel home, suggestions for improved time-keeping, and for improved methods of production have all been dealt with, and both the firm and the employés—the latter numbering some 8,000—are well satisfied with the success of the experiment to date. The most striking feature of the Committee's work has been in settling the many little differences which arise from time to time in a works of such a large size.

Trading Arrangements with Italy.—In an article on "Importation (under Licence) of Italian Goods into the United Kingdom," the latest issue of the *Journal* of the Italian Chamber of Commerce in London makes the following comment:—"This preferential treatment of the French export trade has caused a great sensation in Italy, and has already aroused a feeling of intense bitterness throughout the Italian commercial world. At the time of going to press negotiations are proceeding between the Italian and British Governments, and it has already been announced that the free importation of silk goods, which was first granted to France, has been extended to Italy and other Allied countries. We hope that the British authorities will recognise that the concessions granted to France should be extended, in their entirety, to Italy, because any difference in treatment, besides being unjustified, might endanger the future economic relations between Great Britain and Italy. The present unfavourable condition of the Italian export trade, a proof of which is furnished by the extremely high rate of exchange, and the adverse balance of the foreign trade, is such as to justify the most sympathetic and liberal treatment at the hands of the British Government, and the extension to Italian trade of the same privileges granted to the French trade. Such a decision would dispel the apprehension caused in Italy as to the possibility of future inequalities of treatment in regard to the economic policy of Great Britain towards the Allies, particularly on the subject of Customs duties."

Scarcity of Electrical Goods in South Africa.—The *South African Mining Journal* for September says:—"Materials are getting very scarce in Johannesburg, and such things as keyholders at 7s. 6d., as compared with 1s. 3d. in pre-war days, are practically unobtainable. Switches have sharply advanced to 42s., being a rise of 15s., and very few only are available at that. Wiring is so scarce in some towns on the reef that one is told to supply his own wire to couple up with the main. Inquiries are active for all electrical material, but business is slow through the acute shortage of materials. Jobbing work and contracts are still taken with a general understanding that approved substitutes can be used. All kinds of electrical cable material are very difficult to obtain, and then it is a matter of negotiation as regards the price. Lamps are being absorbed through wear and tear much faster than supplies arrive for replenishment. Relief is expected from America, and, maybe, from the United Kingdom, as the tension there has been taken off somewhat since America entered the war. And now it would seem that it is more a question of shipping facilities rather than supplies if one is willing to pay the higher values ruling in England. The local demand for motors has fallen off since the Municipality cannot supply new electrical power. The contractors complain that work is anything but abundant, since almost all new work in the shape of extensions has been stopped; of course, in a place like Johannesburg there is always a lot of jobbing work and repairs to be done. Hence, as the staffs have been depleted through the recruiting, the various shops seem quite well employed. The general cry is that we could do more if we could only get the materials."

Book Notices.—*The Trade Apprentice* is the title of a magazine inaugurated at "The British Westinghouse" with the idea of bringing together the apprentices, who, owing to the large size of the works in which they are employed, saw little of each other. We understand that in this respect it has been extremely successful. It is edited by Mr. J. C. Prescott, and run by the members of the company's Trade Apprentice School; as it has now reached No. 9 issue, Vol. II, it is evidently well established. Mr. H. A. Carney was the first editor, but was recently obliged to resign the post owing to pressure on his time, and the issue before us contains a cordially appreciative acknowledgment of his pioneer labours, as well as technical articles, a biographical sketch of Michael Faraday, and a humorous account of the T.A.A. sports, as well as other items of local interest, including an entertaining tale of the Ship Canal (described as a "poem"), on the lines of the "Wreck of the Hesperus."

The M. and C. Apprentices' Magazine, the quarterly journal of the apprentices employed at the works of Messrs. Mavor & Coulson, Ltd., for October, has also come to hand. This is now quite a bulky production, and a double number is foreshadowed for the Christmas issue. We note that it appeals not only to the apprentices, to whose enterprise it owes its origin, but also to every grade of employé. A description is given of the recreation camp organised by the firm on the shore of Bardowie Loch, an admirable innovation which deserves the attention of all employers; the remainder of the contents presents a remarkable variety of subjects, ranging from items about shell manufacture to articles on geology, model making, and "penny dreadfuls." The producers are to be congratulated on their success.

Faraday House Journal for the Michaelmas Term contains numerous notes on past and present Faradians, articles on insulation testing and other technical matters, and further additions to the lengthy Roll of Honour of the Institution.

Trade Announcement.—Messrs. E. T. Pearson & Co., Ltd., of 49 and 50, Watling Street, London, E.C. 4, have acquired the rights for France and the French Colonies of the Wild-Barfield process for hardening steel gauges, tools, &c., recently described in our pages.

Electric Furnaces in France.—La Société d'Applications des Fours Electriques is the name of a new company which has lately been formed in Lyons, with a capital of £20,000, to develop the use of electric furnaces.

Catalogue.—Messrs. Pass & Seymour (Inc.), New York.—Eighty-page catalogue of P. & S. handy electric wiring devices.

LIGHTING AND POWER NOTES.

Accrington.—The local Trades Council recently asked the B. of T. to institute an inquiry into the working of the Corporation electricity undertaking. The B. of T., in reply, points out that the undertaking is included in a large scheme for the interconnection of electricity undertakings in Lancashire, and states that the Committee which has the matter in hand is of opinion that the scheme will result in the general efficiency of the undertakings concerned.

Argentina.—The question of the electric lighting in the city of Tucumán has been arranged. The company has agreed to take a bill of exchange for $100,000 m/n. guaranteed by the Provincial Government, in part payment of the amount owing to it.

A company has recently been constituted under the name of "La Electrica," the main object of which is to operate electrical power stations. The capital is $100,000 m/n. divided into 1,000 shares of $100 each. The board consists of the following gentlemen:—President, Enrique Piccaluga; vice-president, Osvaldo Rigamonte; director, Francisco Varela; alternates, Angel Di Benedetto and Oscar Mele; syndic, Santiago G. Rossi; syndic-substitute, Enrique Bonavia.—*Review of the River Plate.*

Barnsley.—The Electricity and Lighting Committee has authorised a report showing the whole of the work necessary to put the plant in an efficient state, together with an estimate of the cost.

Price Increase.—The T.C. has decided to increase the charges for electricity by ¼d. per unit for lighting and 15 per cent. for power, as from October 1st, 1917.

Barrow.—Loan Sanction.—The L.G.B. has sanctioned loans of £10,575 for boiler foundations, steam pipes, &c., and substation plant and switchgear, and £5,325 for mains for electricity extensions. The Council has decided that in the future applications for supplies of electricity for premises within 30 yards of any existing distributing main only will be accepted.

Birkenhead.—Wages.—A strike at the electricity generating station has been settled by the Committee giving the men an advance of 1d. per hour, as demanded. The men refused to accept the Arbitrator's award made recently, but the Committee, considering that the award was binding, did not accede to the request for a larger advance. The Chief Industrial Commissioner pointed out that, although the award could not be varied, there was nothing to prevent the parties concerned further considering the matter, with the result that the Committee reopened the question.

Birmingham.—Wages.—The City Council has approved of a further war wage advance of 3s. per week for the manual employés of the Corporation of 18 years and upwards, and 1s. 6d. to those under that age, the increase to take effect as from August 1st. The estimated cost of the proposed advance throughout the Corporation service is £66,580 per annum.

Blackpool.—Wages.—The municipal employés recently asked for the war bonus of 7s. to be increased to 10s.; the Corporation offered 9s. instead, or to submit the matter to arbitration. The employés chose the latter, and the arbitrators have awarded a total bonus of 12s. for men and 9s. for women. The town clerk has been instructed to write to the Committee on Production, pointing out that the award is contrary to the terms of reference, as the amount awarded is in excess of that demanded. In the meantime, workers in the gas and electricity departments have put in a claim for 15s. a week war bonus, on the ground that they are in a certified occupation.

Bradford.—Price Revision.—On the Electricity Committee submitting for approval the proposed revised and advanced charges for current (previously published in the Electrical Review) to the T.C., Mr. J. F. Waugh moved that the minutes be referred back, and said bulk consumers were already supplied cheaply, and he objected to their receiving preferential treatment as compared with the 4d. flat-rate consumers. Charges to bulk users at Bristol and Birmingham had been advanced, but the result feared by the Bradford Committee had not occurred in those cities. In reply, Ald. Robinson said Mr. Waugh, apparently, would prefer that the whole of the extra cost of coal, wages, &c., should come out of the bulk consumers, but, so far as they were concerned, the Committee had arranged that any variation in the price of coal should be met, and the bulk consumers had met them to the extent of £13,000 in regard to the extra cost of coal. The returns of the department proved that the charges for bulk supply were profitable, but the Committee was supplying firms who could produce their own power, and it was desirable, if they wanted a cleaner city, that the power should be produced at the municipal works. The department had all kinds of consumers to supply, and a general flat rate was out of the question. The minutes were adopted as amended.

Burmah.—The Rangoon Municipal Committee has resolved not to agreed to the proposal to enter into a fresh agreement with the Rangoon Electric Tramway Co. for the public lighting of Rangoon for a period of 21 years, but desires that the Roads and Buildings Sub-Committee should further examine the whole question.—*Indian Engineering.*

Cavan.—Mr. J. P. Tierney, of Dublin, has been authorised to prepare a scheme for an installation of electric lighting in the workhouse.

Chile.—The *Diario Oficial* (Santiago) publishes decrees granting concessions for the installation of electric lighting and power systems (overhead transmission) to Don Leopoldo Chasau—in the town of Los Sauces, Department of Angol; Don Rojelio Pinto—in the town of San José de Maipo, Department of La Victoria; Don Eduardo Valdivieso V. (on behalf of Don Erardo Setz H.)—in the town of Lanco, Department of Valdivia.—*Board of Trade Journal.*

Colchester.—Proposed New Plant.—A report as to the necessity of installing additional plant at the electricity works, in order to be in a position to resume the lighting supply immediately after the war, is to be prepared by the engineer, with a view to a loan being applied for.

Continental.—French Water Powers.—In reply to a question on the subject in the French Parliament, the Minister of Agriculture recently stated that, in accordance with a decree issued in December of last year, all questions relating to the utilisation of the power of non-navigable rivers and streams in the country had for the period of the war been transferred from the Ministry of Agriculture to the Ministry of Munitions. At the same time, close co-operation continued to exist between the two departments, with the object of utilising all available water power, and, as affording some idea of the work that had been done, he stated that plant to the extent of 400,000 H.P. had been established, or was in course of construction, in the Alps, the Pyrenees, and in central France. He also pointed out that, in the case of many of the agreements entered into on behalf of the French Government with hydro-electric undertakings, powers had been reserved under which the generating stations were under agreement to supply for a number of years after the war a certain proportion of the current generated at a cheap rate. Several of the plants in question were in connection with factories making explosives with a calcium carbide base. With the cessation of hostilities, it would not be difficult to convert such plants to cyanamide manufacture, and consequently there were good prospects of large and relatively cheap supplies of synthetic nitrate manures, which would be of great benefit to French agriculture.

Spain.—La Sociedad Electra Rocajo has secured a concession to establish a plant to utilise the water power of the River Najerilla near Brieva (Province of Logrono) in the generation of electrical energy for lighting and power purposes.

The Co-operativa Electrica de Santiago de Compestela is the title of a company, with a million pesetas of capital, formed to supply electricity in Compestela.

Dublin.—During a discussion at the Port and Harbour Board, it was mentioned that there was an increasing demand on the north side of the river for electricity, and it was decided that the Board's engineer should consult with the Corporation's engineering authorities on the subject.

Iceland.—It is announced from Copenhagen that a Danish company has just been formed with the object of utilising the water power resources of Iceland.

India.—According to *Indian Engineering*, the extension of the Coonoor water supply is under contemplation. In connection with the above, it has been suggested that in regard to the question of generating electricity from the Ralliar Waterfalls, it is found that the current thus derived would be sufficient to light the whole station with electricity as well as to supply all the neighbouring estates with power for their factories. The initial outlay would be a lakh and 40,000 rupees, but at present the annual cost of lighting the station is nearly Rs. 6,000, whereas with electricity it would be less than one-third that amount.

Owing to the shortage of electricity meters, and as an alternative to declining to connect new consumers, the Bombay E.L. & T. Co. has submitted to the Corporation a proposal that such new consumers should be charged 1 rupee per point per month, this figure being based on the yield per point of existing consumers of various classes during a recent six months. The Corporation is recommended by its Committee to agree to this as a temporary measure, provided that meters are fitted within one year after the termination of the war.

Leith.—Price Increase.—The T.C. has passed the following increases in the charges for energy:—Power from 1½d. per unit to 1¾d. per unit net; lighting from 4½d. to 4¾d. per unit net. Previously discounts were given. The changes are necessary to meet an estimated deficit of £4,579.

Limerick.—Wages.—On a demand by the electric lighting staff for an increase of 10s. per week in wages, the Electricity Committee offered 5s., which was accepted.

London.—L.C.C.—The Finance Committee recommends the sanction of the Council to the borrowing of £27,825 by the Poplar B.C. for electricity generating plant.

Morocco.—Under the auspices of the Compania Transatlantica, of Barcelona, Spain, a small central electric lighting station has just been completed in Tangiers. Although the plant at present installed only comprises a 200-H.P. Sulzer-Diesel generating set, it is proposed to extend it up to eight such groups in the near future. The engines are to be adapted to run with tar oils, and also, if necessary, to use sea water for cooling purpose.

New Zealand.—The Government National Efficiency Board has invited Mr. J. Orchiston, Chief Electrical Engineer to the Post and Telegraph Department, to report on his proposal for establishing an industry in New Zealand for producing nitrates from the air. Mr. Orchiston has acquired data dealing with the cost of hydro-electric schemes, and in no case, he said, can electricity be generated as cheaply as by utilising any of the large falls in the south-western sounds of New Zealand. One of the simplest propositions is that presented in utilising the Bowen Falls, in the Milford Sound. He estimates that, after making full allowances for all contingencies, energy could be produced for one-fiftieth part of a penny per unit, or 1 H.P. at a cost of £1 per annum. At the Bowen Falls there is deep water close to the side of the sound, and perfect shelter in all kinds of weather.—*Journal R.S. of Arts.*

Rotherham.—The Electric Light and Tramways Committee has received a communication from the Ministry of Munitions that its present policy is that no facilities will be given to the Sheffield Corporation beyond those already authorised, so long as the Rotherham Corporation has sufficient plant for the inter-supply of current to the Sheffield Corporation on reasonable terms.

St. Anne's-on-Sea.—Year's Working.—The annual report of the working of the Council's electricity undertaking for the year ended March 31st last shows a total revenue of £14,952, working expenses amounting to £11,368, and special expenses £1,074, making the total expenses £12,442, and leaving a gross profit of £2,510; with £864 transferred from the war munitions account, making a total of £3,374, and deducting interest and sinking fund, and bank charges, &c., £3,459, a deficit on the year's working of £85 resulted, which has been debited to the reserve fund. During the year 1,494,488 units were sold, an increase of 187,188.

South Africa.—The Works Committee of the Krugersdorp (Transvaal) Municipal Council reports that it has under consideration the question of increasing the charges for electric light connections. It points out that the price of copper wire has risen from 10d. to 4s. per lb., and of other materials by at least 100 per cent.; also that at the present time it is impossible to obtain good cut-outs, and that makeshifts have to be used.

Stratford-on-Avon.—Electricity Prices.—A Committee has recommended the T.C. not to accede to the request of the local Electricity Co. for leave to increase the charge for current for the period of the war and 12 months after, from 6d. to 6½d. per unit, but the matter has, by the casting vote of the Mayor, been referred back for re-consideration.

Stretford.—At a recent meeting of the U.D.C. it was reported that the clerk had submitted to the chairman of the Legal and Parliamentary Committee a statement of points which it was desirable should be given in evidence by the representatives of the Urban District Councils' Association before the B. of T. Electric Power Supply Committee. The following is a summary of the statement:—(1) Principle of distribution by local authorities should be retained; (2) that no charge should be made on the general body of ratepayers for the benefit of electricity consumers, and that the outstanding debt of any small superseded station should be taken over by the super-station authority; (3) that the super-station authority should be under obligation to supply energy in bulk; (4) that the super-station authority should be under obligation to supply energy to local authorities at uniform rates; (5) large power consumers should be supplied through the local authority, and not direct from the super-station authority; (6) local authorities should have preponderance of representatives on super-station authority. The Council approved the statement.

Todmorden.—The annual accounts of the Corporation Electricity Department, submitted last week, show an income from sale of current of £3,107; other income, £277; working expenses, £4,094 and a deficit on working of £709. Sinking fund and interest allowances amounted to £1,964, making a total deficit of £2,673, which has been met by a transfer from the district fund revenue account. The deficiency last year was £1,580. The loan capital outstanding at March 31st, 1917, was £19,585.

U.S.A.—The Kansas City Light and Power Co. has contracted with the General Electric Co. (U.S.) for two 25,000-KW. turbo-generators for its new power plant, which is designed for an ultimate capacity of 240,000 KW.

Wakefield.—The electrical engineer reports that during the past year, owing to the pollution of the river with chemical waste, considerable trouble has arisen from corrosion. In October a reserve stock of coal caught fire, occasioning considerable loss, and in February a fire occurred on the H.T. switchboard, interrupting supply for 9¼ hours. During the year 4,415,108 units were sold, equal to 83 units per head of population.

Workington.—Prov. Order.—The T.C. has decided to apply to the B. of T. for a prov. order for electric supply.

TRAMWAY AND RAILWAY NOTES.

Belfast.—At the meeting of the Tramways Committee, it was reported that the receipts for the past month showed an increase of £1,600 as compared with the corresponding period of last year. A report on the state of the track was also presented.

Birmingham.—Arterial Roads.—An important report, embodying proposals for reconstructing and widening arterial roads, engaged the attention of the City Council last week. It stated that during the past 20 years £492,375 had been expended by the Tramways Committee and the Public Works Committee in carrying out the widening of parts of the main thoroughfares in connection with general improvements and electric tramway developments. The average yearly outlay amounted to £44,761. Notwithstanding that expenditure (large in comparison with the results achieved), not a single one of the city's main arteries had been so widened that its further widening was not a concern of the present generation. The proposal was to widen the eight great arterial roads which ran into the centre of Birmingham, together with four that led off them, to 110 ft. and 120 ft. The Tramways Committee was contemplating the adoption of the single-deck car, and it was hoped ultimately to run these on independent sleeper tracks. An advantage was that, if in the future it was decided to increase the gauge of the tramways from 3 ft. 6 in. to 4 ft. 8½ in. it could be done upon the sleeper-track system with comparative ease and low cost upon the width provided. The only practicable position for track, in a shopping or business street, was in the centre of the road, consequently it was necessary to provide a carriage way on either side. The minimum width required was 27 ft. for the tramway track and 24 ft. for each of the two carriage ways, making together 75 ft. between the pathways; footpaths 17 ft. 6 in. each, would give a total street width of 110 ft. The 27 ft. of tramway track would provide the necessary standing room for passengers. The cost of the necessary street widenings was estimated at £642,704—an amount which would be spread over a number of years. The tramway manager (Mr. A. Baker) states that the present cars are too heavy and cumbersome (a double-deck car such as now used weighs about 15 tons unloaded, and getting on for 20 tons loaded), that they accentuate the congestion of traffic, are noisy, and that much damage is done to the tramway track. The cost of maintenance, both to the track and rolling stock, is extravagantly heavy. The remedy is the provision of single-deck cars on independent tracks. It is estimated that the annual saving from independent sleeper tracks would be £70,000 in cost of reconstruction and repairs and maintenance of permanent way, £10,000 on repairs and maintenance of rolling stock, and £20,000 in operating expenses accruing from a better time table.

Bury.—The manager of the Corporation Tramways has reported to the Committee that, in consequence of increased rate of wages paid to the employés, it will be necessary to raise the fares; it has been decided to draw up a revised table of fares.

Continental.—Spain.—The abridged scheme for an underground electric railway at Madrid, 4 km. in extent, which is about being taken in hand, is estimated to cost 8,000,000 fr., being 4,100,000 fr. for the underground construction works, 1,000,000 fr. for surface works, and 1,650,000 fr. for rolling stock. There will be nine stations; the trains will be made up of five carriages, with accommodation for 250 passengers, the service being every two or three minutes.—*L'Elettrotecnica.*

Dover.—At a meeting of the Tramways Committee, it was proposed to levy a special 6d. rate to meet compensation claims arising out of the recent accident; a suggestion was made that a 2s. 6d. rate would be required, which would give some £23,000. A scheme for reducing the gradient on the hill on which the accident took place was considered.

East Ham.—Year's Working.—In a recent issue we gave the borough treasurer's figures for the working of the Corporation tramways during 1916-17, showing a deficit of £2,395. According to figures published by Mr. Ullmann, the manager, the deficit amounted to £3,213. During the year 18,619,000 passengers were carried, as against 20,428,000 in the previous year, the car-mileage being also reduced. The revenue per car-mile was 10·04d., as against 9·87d., and the operating cost was 8·83d. per car-mile, or nearly 1d. in excess of 1915-16. Some 40 per cent. of the receipts were from ½d. fares, but these were abolished on March 1st.

Halifax.—Discount Tickets.—The Tramways Committee, last week, agreed to grant a request by the organised tradesmen of the town that the Committee should sell tickets in blocks of 500 each, at a discount of 25 per cent.

Leeds.—Traffic Returns.—The accounts for the city tramways undertaking for the first six months of the current year up to the end of September were presented to the Tramways Committee on Monday. The total receipts amounted to £296,867, which is a record for six months' working, and an increase of £28,846 on last year's figures. These figures have been attained in spite of a decreased service, 40,724 fewer car-miles having been run. The earnings per car-mile work out at 14·618d., a very high figure, being 1·529d. more than in the corresponding period of last year. The number of passengers carried was 61,823,986—4,565,347 more than last year. The number of cars in use was 238, and the amount per head contributed by the population was 10s. 9d. The working expenses for the half-year total £150,190, an increase of £22,000, being about half the total receipts. The increase in ex-

penditure is attributed to war bonuses and to enhanced cost of materials used in repairs. Traffic expenses amounted to £12,583 and general repairs to £8,869. Increased income-tax and reserve fund charges cover £6,000. The estimate for the whole year provides for a surplus of £55,000 in relief of rates, and this, we gather, is likely to be fulfilled.

London.—L.C.C.—The Highways Committee reports that during the 11 weeks ended October 3rd 127,344,961 passengers were carried on the Council's tramways, a decrease of 3,469,325 as compared with the corresponding period last year. The traffic receipts during the same period amounted to £635,415, an increase of £83,144; the total receipts from April 1st, 1917, show an increase of £187,806 as compared with 1916.

TELEGRAPH AND TELEPHONE NOTES.

A Large Submarine Cable.—The New York Telephone Co. has laid across Raritan Bay a cable nearly 5½ miles in length, containing 74 pairs of wires, and superseding 3,000 miles of overhead wires previously in use on the land route. It is claimed that this is the largest submarine cable in the world.

Argentina.—Early in August the Ministry of Marine was informed that a wireless station was at work in the neighbourhood of Trelew, and a search was made. Eventually it was discovered with the aid of a cruiser, on the premises of a business house in the town of Trelew. Considerable reserve is maintained on the subject.

The concession applied for by Señor A. Schwimmer for the installation of an automatic telephone system in Buenos Aires has been discussed by the Municipal Commissioners, and referred back to the Mayor.—*Review of the River Plate.*

Dewsbury.—The Chamber of Trade has put before the Home Office a scheme of telephone warning to shopkeepers of air raids, so that shop lighting restrictions may be relaxed, at any rate within a quarter-mile radius of the centre of the town. The proposal is that six shops, covering six areas of the town, should receive telephone warning of a raid from the exchange. These six tradesmen would each warn six others, and they, in turn, would warn groups of shopkeepers in their neighbourhoods, as allotted to them. It is held that by this means, the whole of the lights of the 196 shops in the main town area could be extinguished within five minutes of the receipt of the original telephone warning from the exchange. Shops electrically lighted would not need the warning, as their lights would be cut off at the power station. The Home Office has asked the Chamber for further details, pointing out that the scheme presents difficulties, but that it is to receive every consideration. The Chamber is also conferring with the chief constable of the town as to police co-operation.

Dutch Cable Blockade.—Commercial cable communication with Holland was interrupted last week by order of the British Government until such time as the Netherlands Government consents to put a stop to the transit of sand, gravel and scrap metals through Holland from Germany to Belgium.

The use of British cables is a concession which cannot be claimed as a right, as any messages which are allowed to pass do so as an act of grace.

Windhuk (South-West Africa Protectorate).—A party of Union of S.A. members of Parliament, whilst making a tour of the Protectorate, paid a visit to the wireless station at Windhuk, and a description of the station was given to them by Capt. Kellaway. The motive power consists of two Diesel oil engines. The large A.C. generators are designed for a single-phase output of 250 KW, at 500 volts and 350 cycles. The transformers are of the oil type, designed to step up from 500 volts to 52,000 volts. There are five masts each 390 ft. high, weighing roughly 30 tons each, all insulated, and all maintained in position by steel wire cables. The transmitting aerial consists of 20 silicium-bronze cables, 10 running south-east and 10 south-west from the apex. The two receiving aerials consist of ¼-in. diameter silicium-bronze cables. The battery comprises 128 Tudor cells of 270 ampere-hour capacity.

It was explained that the transmitting plant of the wireless station was inoperative owing to the removal of essential parts by the Germans. The receiving of messages is being maintained.

CONTRACTS OPEN AND CLOSED.

OPEN.

Dublin.—November 1st. G.N. Railway Co. (Ireland). Six or twelve months' supply of general stores (including several electrical items). See "Official Notices" October 5th.

Grimsby.—October 29th. Corporation. House service boxes and house fuse-boxes and fittings. See "Official Notices" October 12th.

CLOSED.

Bath.—C.C. Five-ton "Sentinel" steam wagon, £970 net: Alley & MacLellan, Ltd.

Cape Town.—Tenders received for the wiring of the new Union Jack Club:—

R. G. Jack	(accepted)	£210
J. A. Woods & Co.		237
Edward A. Shaw & Co.		242

Glasgow.—Tramways Committee. Tenders recommended:—Cable: Liverpool Electric Cable Co., Ltd.; B.I. and Helsby Cables, Ltd.

Hereford.—T.C. Electric motors and pump: Mather and Platt, Ltd., £736.

London.—L.C.C.—Highways Committee. Electric cables for the Council's tramways:—

Western Electric Co., Ltd.	(accepted)	£1,430
W. T. Henley's Telegraph Works Co., Ltd.		1,462
Callender's Cable & Construction Co., Ltd.		1,480
B.I. & Helsby Cables, Ltd.		1,480
Johnson & Phillips, Ltd.		1,480
Siemens Bros. & Co., Ltd.		1,490
W. T. Glover & Co., Ltd.	(part only)	950

(General Manager's estimate, £1,200.)

Steel tires for tramcars (1,500 driving-wheel and 750 pony-wheel tires). Accepted tenders:—

Brown-Bayley's Steel Works, Ltd.	£7,204
Patent Shaft & Axletree Co., Ltd.	7,990

Southend-on-Sea.—T.C. Tramway undertaking:—

Edgar Allen, Ltd.—Switches, crossings and fish-plates, £54.
Hadfields, Ltd.—Three pairs of points and three crossings, £237.

Sunderland.—T.C. Electricity and Lighting Committee. Steel tubes: Dewhurst Engineering Co.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 19th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. "A Comparison of the Working Costs of the Principal Prime Movers," by Mr. Oswald Wans. General meeting.

Junior Institution of Engineers.—Friday, October 19th. At 8 p.m. Lecture on "The Application of Coal Gas to Commercial Vehicles," by Mr. W. A. Tookey.

British Empire Producers' Organisation.—Thursday, October 25th. At 1.30 p.m. At the Waldorf Hotel. Luncheon meeting. Marquis of Graham to preside. Guest, Right Hon. John Hodge, P.C., M.P., Minister of Pensions.

Institution of Civil Engineers.—Thursday, October 25th. At 3.30 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Meeting to consider the establishment of a central organisation for improvement in and better co-ordination of engineering training, and the appointment of a representative committee to initiate action.

NOTES.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—
Officer for the Week.—Lieut. C. E. Campbell.
Drills.—Week ending Saturday, October 27th, 1917:—
Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.
Tuesday.—Physical drill and bayonet exercise, 7.30.
Wednesday.—No. 1 Company, 6.30.
Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.
Friday.—No. 3 Company, Right Half. Recruits, 6.30.
Musketry.—Belvedere Road. Tuesday, Wednesday, and Thursday, 5.30 to 7.
Note.—The Medical Officer will attend for examination of recruits, &c., on Thursday at 6.
Unless otherwise indicated, all drills take place at Headquarters.

(By order) MACLEOD YEARSLEY, *Capt. and Adjutant.*

Cranemen's Wages.—There has been correspondence between the Aberdeen Harbour Board and the Chief Industrial Commissioner with respect to the wages of steam and electric cranemen, who have asked for an increase. After full consideration, the Board's Committee has decided that the matter is not one that can be settled by mutual agreement, and has replied to the Industrial Commissioner stating that the difference must be settled by arbitration.

Mechanical Arms.—At the Junior Institution of Engineers, on Monday evening, Mr. E. W. Hobbs read a paper on "Mechanical Arms." The anatomy and mechanics of the natural arm were described, and reference was made to early artificial arm work and to the requirements of an efficient mechanical arm. The effect of the amputation and its bearing on the mechanical arm were discussed, and other points touched upon were:—The vocation of the wearer and its bearing on the mechanical arm; the mechanism of the mechanical arm; the mechanism of the mechanical hand; various types of artificial limbs, their peculiarities and working; and some results achieved. In connection with the paper, Mr. Hobbs has arranged for a demonstration on Saturday, October 27th, at 3 p.m., at the Hall of the Balham Constitutional Club, 211, Balham High Road, S.W. Afterwards he will show his works, which are near at hand, to anybody who is specially interested.

Validity of Tungsten Wire (German) Patent Upheld.—The German patent No. 269,498 (1910) granted to the Allgemeine Elektricitäts Gesellschaft, with priority from October 6th, 1909, on claim (1) and from February 23rd, 1910, on claim (2), has been upheld successfully against the annulment suit brought by the Wolframlampe A.G. (Augsburg), the Radium G.m.b.H. (Wipperfurth), and the J. Pintsch A.G. (Berlin). One of the most interesting patent cases of recent years is thus decided wholly in favour of the patentees. The patent in question relates to a process for the manufacture of tungsten wire for use in glow lamps. According to the specification, the process consists principally in bringing tungsten powder to the form of a coherent body by suitable means —heating it to 1,000—1,200° C. in an iron tubular furnace, through which hydrogen is passed, and then raising it to near melting point by the passage of current, the metal being again in an atmosphere of hydrogen. Finally, the metal is prepared for use by repeated mechanical working (rolling, hammering, drawing, &c.). The text of the actual claims is :—(1) Process for manufacturing tungsten wire for electric glow lamps, characterised by coherent pieces of tungsten being subjected to mechanical "working" until they become flexible and ductile at ordinary temperatures. (2) Use of initial material in the form of a comparatively coarse powder, the porous body formed therefrom being heated to a very high temperature.

Opposition to this patent and the subsequent action contesting its validity were based on the contention that prolonged mechanical working was a well-known means of securing flexibility and ductility in metals, and its application to an individual metal (tungsten) not previously considered ductile was not sufficient ground for granting patent rights. The Courts did not support this view. The following opinion is interesting :—"The literature submitted shows that many attempts had been made to make tungsten filaments by drawing (instead of by squirting and paste processes), using methods employed in general wire drawing or for the manufacture of other metal filaments (*e.g.*, tantalum). It is clear, however, that one could not simply substitute one metal for the other. All assertions and proposals are, therefore, to be ruled out, in which the behaviour of tungsten is deduced from that of other metals."

The firms in enjoyment of the valuable patent thus maintained are A.E.G., Siemens & Halske, the Deutsche Gasgluhlicht A.G., the Bergmann Elektricitäts Werke A.G., and the firm of Philips (Einthofen). These firms have now a monopoly in the (German) manufacture of drawn-wire tungsten filament lamps, but this monopoly does *not* embrace :—(1) The manufacture of "Einkristallfaden," by Pintsch's process (*E.T.Z.*, page 234, 1917); (2) drawn-wire filaments of tungsten alloy, even though tungsten be the chief ingredient; (3) tungsten wire-drawn by the same process for other applications than glow lamps.

The various actions commenced by the A.E.G. in respect of infringements of its Patent No. 269,498 must now be decided against defendants wherever the latter have been making filaments of pure drawn tungsten wire. A considerable portion of the German glow lamp industry is thus paralysed unless the offending members succeed, at the last moment, in securing licences from the A.E.G. —*E.T.Z.*

Ventilation on the Tube Railways.—Referring to this subject, the *Times* states that it has received numerous inquiries regarding the possibility of disaster to the ventilating apparatus of the tube railways, and as a result has obtained the following statement from the engineer to the London Electric Railway Company :—

"We are unable to anticipate any condition which will render the air in the tube railways unsafe. The tube railways ran for a number of years without any artificial ventilation whatever. There is very considerable ventilation caused by the motion of the trains in the tunnels—quite sufficient in itself to prevent the air becoming unpleasant. The shutting down of the whole of the electrical supply on the London Electric Railways would not affect the running of the fans in that we have an alternative means of power supply from a quite independent source. Individual damage to one station, or one fan, would only put that fan out of commission, and the fans at adjacent stations would keep the ventilation going."

We stated in our last issue that the risk was small.

The A.S.E.—The *Times* states that the Executive Council of the Amalgamated Society of Engineers has passed a resolution recommending that the Society should secede from the Engineering and Shipbuilding Trades' Federation. The opinion of members will be obtained by a ballot. Although the engineers' membership is practically half that of the whole of the Unions represented, their representation on the Federation is only equal to that of the smaller Unions, and this fact has caused considerable irritation.

L.C.C. Electrical Employes.—The Highways Committee reports that leading cable hands, cable hands, overhead linemen, feeder pillar hands and watchmen (Southern Section) in the electrical branch of the tramway department have asked that their war bonus may be increased to 19s. a week, that men paid by the hour be guaranteed minimum wages for 50 hours a week, and that men paid by the shift, day, or week, be guaranteed minimum wages for six shifts or days a week, and that their requests be referred to the appropriate Conciliation Board in the event of the Council not acceding thereto. A fitter's labourer and a skilled labourer on the sub-station repairs staff have asked for additional war wages of 12s. a week, and switchboard attendants and temporary sub-station attendants (Northern Section) have asked for an additional war bonus of 8s. a week. The Committee recommends that the applications be referred to the Electrical Conciliation Board.

Foreign Trade.—September Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

	September, 1917.	*Inc. or dec.*	9 *months*, 1917. *Inc. or dec.*
Imports.			
Electrical goods ...	94,543	— 38,036	— 189,955
Machinery	805,792	+214,845	— 63,313
Exports.			
Electrical goods ...	186,999	—210,282	— 855,882
Machinery	1,474,666	—290,552	+ 426,659

Motive Power from Plant Life.—Lecturing, last week, at the Austin Works, Northfield, Prof. F. W. Burstall, of Birmingham University, said the question of suitable fuels for automobiles had become a serious problem. It had long been predicted that a time would come when some other fuel would have to be employed unless the use of the mechanically-propelled vehicle was to be seriously retarded. The advent of the war and the extensive use of the internal-combustion motor had caused a shortage of petrol much more serious than would have been the case in times of peace. The position would not to any great extent be relieved by the advent of peace, owing to the fact that as time went on the use of small motors would be much extended.

Prof. Burstall outlined some of the methods which might be used for the production of fuel. Many of our ablest men, he said, had been working on this problem for a considerable time. The amount of light spirit derived from carbonaceous material was a limited quality, and very much less than the world's demand. One alternative was to employ an engine capable of dealing with the heavier oils, as was being done in many directions by the heating and working-up of the heavy oil into a gas. Another was the use of gas in a more or less compressed state, which undoubtedly had many features to recommend it. Such solutions were only partial. Alcohol formed practically an ideal substance for engine purposes, but its use as fuel had been retarded by its high price. For the main part, alcohol for manufacturing purposes was derived from starch which was unsuitable for food, and the scarcity of the raw product would most certainly increase its price as the demand increased. We did not know how far the direct change from sunlight to starch could be carried out in suitable localities in suitable plants, but there was no doubt the energy was there in quantities sufficient to satisfy all the demands; what had to be learnt was how to utilise and store up that energy in a form rendering its applications simple and effective.—*Birmingham Daily Post.*

Prize Essay.—"Hydro-Electric Power in India: its Present Position and Possible Future Development" is the subject selected by the syndicate of the Bombay University for competitive essays for the Ashburner Prize for 1919.—*Indian Textile Journal.*

Patents and Alien Enemies.—Application has been made to the Board of Trade by Messrs. J. S. Highfield, A. A. C. Swinton and P. D. Tuckett, to avoid or suspend 17 patents granted to Farbwerke vorm. Meister, Lucius & Bruning, Schwerin, and Ges. für Elektro-Osmose m.b.H. for processes relating to electro-osmosis and similar purposes; and for the grant of licences under "Applications to be vested in the Custodian," in respect to 17 applications in the name of the Ges. für Elektro-Osmos m.b.H. and Elektro-Osmos Akt.-Ges. (Graf Schwerin Ges.), of a similar nature.

The Association Movement.—The following important letter reaches us just as we go to press :—

"My attention has been called by several members of the Cable-Makers' Association to an article by Mr. H. H. Berry in your last issue, in which he appears to claim that he is the founder of the C.M.A. I have myself, as a director of W. T. Glover & Co., Ltd., been closely associated with the C.M.A. for over 14 years, and in that time have never heard Mr. Berry's name suggested as connected with the foundation of the Association. From inquiries made since Mr. Berry's article appeared, it would seem that he certainly had the idea to found a trade organisation, and took some steps in that direction; but these came to nothing. The actual genesis of the C.M.A. came in quite another direction, springing, I believe, from a beginning made by Mr. James Taylor (Helsby Telegraph Co., Ltd.) and Mr. George Sutton (Henley's Telegraph Works Co., Ltd.). But the definite decision to found the Cable-Makers' Association was taken at a meeting convened in 1898 by Mr. Henry Edmunds, then chairman of W. T. Glover & Co., Ltd., and the first formal meeting, at which the foundation was accomplished, was held on January 10th, 1899, when the following signed the roll in the order given :—

"Henry Edmunds (chair), Alex. Siemens, J. J. Easton, W. P. J. Fawcus, James Taylor, Francis Lamb, W. E. Gray, Jas. Connolly, G. Sutton, R. J. Hatton, W. Claude Johnson, J. Paterson, Godfrey Samuelson, A. H. Howard.

"It is with no wish or intention of in any way belittling Mr. Berry's efforts in connection with the Association movement that I am writing, but historical accuracy and justice to other early workers in the now fashionable field of trade organisation make this correction necessary.

"Llewelyn B. Atkinson,
"*Secretary, Cable-Makers' Association.*

"Sardinia House, Kingsway, W.C. 2,
"*October 18th*, 1917."

Fuel Research.—The Report of the Fuel Research Board to the Department of Scientific and Industrial Research on their scheme of research and on the establishment of a fuel research station has been issued. It states that in the first report (which was not published) the Board proposed two main lines of research: a survey and classification of the coal seams in the various mining districts by means of chemical and physical tests in the laboratory; and an investigation of the practical problems which must be solved if any large proportion of the raw coal at present burned in its natural state is to be replaced by the various forms of fuel obtainable from coal by carbonisation and gasification processes. The two lines can be most satisfactorily dealt with side by side. In preparation for the organisation for the first line, however, an experimental study of standard methods for the examination of samples of coal in the laboratory has been made, and as a result of experimental work carried out in the Fuel Laboratory of the Imperial College of Science and Technology a test has been elaborated which, by direct weighing and measurement, gives the yields of gas, oil, water, and carbonaceous residue which results from carbonisation at any definite temperature, with simple apparatus, which is being standardised. The representatives of the coal owners show every disposition to co-operate in the work of collection and registration of samples when the Board is ready for them.

The second line of inquiry has been led up to by a variety of influences during the past eight or ten years, including the demands for cheaper and more ample supplies of electrical energy, for home supplies of fuel oil for the Navy and of motor spirit for the Transport and Air Services, and for smokeless domestic fuel, due to the growth of public opinion on the subject of smoke prevention. The only development which would satisfy all these needs simultaneously would be the replacement of a large proportion of the raw coal which is at present burned in boilers, furnaces, and domestic fires, by manufactured fuels prepared from raw coal by submitting it to distillation. The gas retort and coke oven have become highly developed appliances for the carbonisation of coal at temperatures ranging from 900° to 1,200° C., on which subject a great amount of experience and trustworthy data are available; but as regards the carbonisation of coal at low temperatures there is no such body of experience and information in existence. The way is clearly open for a serious attempt to determine whether an economical and efficient apparatus can be devised for the carbonisation of coal at low temperatures, and whether, by its use, products will be obtained of a collective value greater than that of the original coal, plus the cost of carbonisation and handling. The evolution of such an apparatus is at the root of the whole matter.

The questions before the Board are whether the 35 to 40 million tons of raw coal used annually for domestic heating can be replaced by smokeless fuel prepared by the carbonisation of the coal; whether adequate supplies of fuel oil for the Navy can be thus obtained; whether supplies of town gas can be produced more economically by new methods of carbonisation; whether electric power can be obtained more cheaply if the coal used for steam raising is first subjected to the processes of carbonisation and gasification; whether more scientific methods of using fuel will enable the peat deposits of the United Kingdom to be utilised for industrial purposes; and whether the use of gaseous fuel in industrial operations can be forwarded by the development of more scientific methods of combustion. The answers to these questions will only be obtained by co ordinated research carried out on the lines of a broad and well-considered scheme.

Outlets for all the products of carbonisation must be found; no new scheme can be justified if it can only live by poaching on the preserves of the existing industries. The Fuel Research Board, which is in touch with other Government departments, is exceptionally placed for the furtherance of schemes which involve the finding of large outlets for such products.

Enormous quantities of coke would be produced, and its disposal at a profitable price is a vital question; the research scheme must, therefore, include a very complete inquiry as to the use and value of this coke for the direct firing of steam boilers; its gasification in producers and recovery of its nitrogen as ammonia; and its use for industrial and domestic heating.

As an illustration of the complicated inquiries which will have to be conducted before an answer can be given to what seems to be a simple question, the Board points out that there is a very general belief among electrical experts that the future of British industry will be greatly affected by the cost at which power in bulk can be supplied in the form of electricity. It has been proposed, for instance, that large electrochemical works should be established in this country for the manufacture of products which in the past have been manufactured in parts of the world where cheap water power is available. In this connection it has been suggested that the cost of producing power from coal in this country would be substantially reduced if, instead of burning the coal directly under the steam boilers, it were first subjected to carbonisation and gasification processes which, in addition to fuel gas, would yield valuable by-products. Plausible statements have been issued showing the enormous savings or profits which would accrue if schemes of this sort were adopted. Unfortunately these estimates have generally been made on a very slender foundation of knowledge and experience. On the other hand, those who by experience and practice are best qualified to judge, hesitate to prophesy as to what the economic result of a combined carbonisation and power generating scheme would be, but they agree that the interests at stake are so great that the question ought to be authoritatively answered once for all. But no answer can be accepted which is not founded on the complete working out of the scheme, no important step in the series of operations being omitted or slurred over. This series of operations will start from the mechanical preparation of the coal and its conversion into solid, liquid, and gaseous products by carbonisation. It will end with the delivery of a known weight of high-pressure steam under the conditions most favourable for power production by turbo-generators. In the proposed scheme of research the investigation of each of the steps involved in the above inquiry is provided for. Three, at least, of these steps involve pioneering work on an industrial scale, and the work may occupy a considerable time. The Board realise that it is possible that the net result of this particular inquiry may be to show that purely as a means of cheapening the cost of electric power, the use of carbonisation methods has not much to commend it, but that certain incidental advantages will justify its use in particular cases.

A Fuel Research station, fully equipped for carrying out operations on an industrial scale, has been planned, and Dr. Carpenter, on behalf of the South Metropolitan Gas Co., has offered to lease to the Government, at a nominal rent, sufficient land at the East Greenwich Gas Works for the purpose, as well as to assist in its design and erection, and to purchase at market prices the surplus products resulting from its operation.

The Report is signed by Sir George Beilby, Director of Fuel Research; the other members are Sir Charles A. Parsons, Sir Richard Redmayne, and Sir Richard Threlfall, with Prof. W. A. Bone as consultant.

Engineers' War Bonus.—The Minister of Munitions announces the granting of a 12½ per cent. bonus on the earnings of fully qualified skilled engineers and moulders rated at or above the current district time rate for turners or fitters while employed on or in connection with munition work and paid at plain time rates without the addition of any bonus. This new order means that the skilled man is put on terms of equality with the unskilled or semi-skilled man, who, paid on piecework for mechanical production, has been able to earn more than the skilled man who taught him his job. The new bonus does not interfere with or substitute bonuses to skilled men dependent on time-keeping and on output and war advances to meet the cost of living, but it does not apply to workmen paid an upstanding wage which covers overtime or other allowances. It accrues from the beginning of the first full pay day following October 12th, and the first payment must be made by the first full pay day in November.—*Manchester Daily Dispatch.*

Fire in Leipzig Telephone Exchange.—On August 9th a serious fire occurred on the switchboard of the Leipzig Telephone Exchange, the cause being apparently the failure of a fuse to act. The installation consists of a central battery system, with accommodation for 20,000 connections provided on two separate series of boards. The fire broke out near the end of the first set of boards, and, although it was detected soon after its outbreak, it spread so rapidly that the whole of a multiple board was destroyed, and 11,000 subscribers were cut off. Incoming trunk service could be maintained, and about 5,000 subscribers served by semi-automatic equipment were not directly affected by the disaster. In order to restore communication as quickly as possible, the multiple board was cut at the point of the fire. About 4,000 lines (the call signals for which lay between the main distributing frame and the seat of the fire) were restored to service within two days. A start was then made in bridging the burnt-out sections, and, although space was so restricted that only a few men could work at once, more than 80,000 soldered joints were made, and regular service was restored "within a few days."—*E.T.Z.*

The Leaving Certificate and Munitions Work.—With regard to the Order of the Minister of Munitions abolishing the Leaving Certificate from October 15th, it is to be hoped that those who are engaged in the manufacture of munitions will not allow this alteration to operate in such a way as to disorganise work, impeding output and creating temporary unemployment. We trust that the action taken in conference with Trade Unions and Associations of Employers will be found to sufficiently meet the position. It should be borne in mind that skilled men must not be engaged or employed to replace unskilled or semi-skilled men employed on or in connection with munitions work, or to do work previously done in the establishment by such unskilled or semi-skilled men; that men must not be engaged or employed to replace women employed on or in connection with munitions work, or to do work previously done in the establishment by such women; and that employers must not engage labour for munitions work except to replace men who may leave, or to carry out orders in hand on which additional men may be immediately employed.

Fatalities.—A verdict of "Accidental death" was returned at the inquest on John Ashcroft (27), labourer, of Hooley Hill, who was killed at Messrs. Jones's sewing-machine works, Guide Bridge. The evidence was that the deceased, a discharged soldier, was working about 10 yards from the electric switchboard. All at once the lights were turned on, and someone cried, "Look at Johnny!" Ashcroft was seen with his right hand on the switch and his head thrown backwards. He was released, and a doctor sent for, but the man died before he reached the infirmary. The switch carried A.C., 240 volts, and the only explanation that could be offered was that one of the covers had become loose and formed a contact with the terminals, and the man might have put his hand on the cover. The switches were of an approved type, and were renewed in February. This one was tried next day and found all right.

During a storm at Durban, early in September, an electric light wire fell on a rickshaw boy, killing him. The bare feet and scanty clothing of the native would put him at a disadvantage compared with a man dressed in the European style.

Association of Electrical Station Engineers.—A meeting was held in Manchester on October 11th, at which 36 engineers were present. The following resolutions were carried unanimously :—"That the engineers in the Manchester district be urged to join the A.E.S.E., and endeavour to run the branch on the best possible lines."

"That this meeting of Manchester staff engineers expresses a vote of confidence in the London Branch in their claim to represent the interests of staff engineers as against that of the E.T.U."

Officials and a Committee were provisionally appointed, and it was suggested that the A.E.S.E. should be open to accept mechanical engineers as well as electrical engineers holding staff appointments. The next general meeting is to be held on October 25th, place and time to be announced.

London Power Station Engineers.—The following letter has been addressed by the Association of Electrical Station Engineers to all chief engineers and London Borough Councils :—

Sir.—I am instructed by the Executive Committee of the above Association representing the following engineering grades of power station technical assistants of London electricity supply authorities :—

Engineers-in-Charge.
Assistant do.
Junior do.
Mains Assistants.
Meter Superintendents.
Draughtsmen.
Testing Engineers.
Installation Inspectors.
Commercial Assistants and
Publicity Engineers.

To request immediate consideration of the following resolutions passed at a recent conference of power station engineers represented by this Association, and to ask that you will bring the matter before your Council at the earliest possible moment.

1. That in view of
   (*a*) The abnormal increase in the cost of living ;
   (*b*) The fact that operative staffs have been met in this matter by various awards of the Committee of Production (Ministry of Munitions),
   A request be made that
   A bonus or war wage of 15s. per week be granted to all engineering assistants in the above mentioned grades dating from August 1st, 1917.
2. That in view of
   (*a*) The anomalies in remuneration of engineering assistants in the above-mentioned grades created during the past three years by the fact that no uniformity of treatment has obtained amongst supply authorities on the question of annual increments for added responsibilities ;
   (*b*) The fact that the remuneration of such assistants has at no time been commensurate with the qualifications demanded,
   A request be made that
   A 25 per cent. increase of the pre-war (July, 1914) salary attaching to the offices of the engineering assistants in the before-mentioned grades be granted to all such assistants.
3. That in view of
   The lack of uniformity obtaining in London power stations amongst engineering assistants engaged on shift duties in the matter of
   (*a*) The number of hours per shift ;
   (*b*) The number of shifts per week,
   A request be made that
   (*a*) A normal shift shall consist of eight hours ;
   (*b*) A normal shift week shall consist of six 8-hour shifts, qualified as follows :—
   That where the staff arrangements permit, the above concession be immediately made.
   That where depletion of staffs due to war emergency do not permit, an undertaking be given that such condition shall obtain as soon after the cessation of hostilities as is practicable, or within a definite period of such date.

I shall be glad to have your assurance that the above matters will receive your careful consideration.

Yours faithfully,
W. Arthur Jones, A.M.I.E.E.
Hon. Secretary, A.E.S.E. (London).

The Association of Engineering and Shipbuilding Draughtsmen : London Branch.—The annual general meeting of this Branch was held on September 22nd, when about 350 members were present. Mr. E. H. Walker (President) was in the chair, and gave a very satisfactory report of the work of the London Branch since its formation in February, 1917. Interviews have been held with the Ministry of Munitions on the subject of leaving certificates, &c., and the Association has been represented at several arbitration cases concerning draughtsmen. Owing to the largely increased membership in the London area, it has been decided to form a new branch for S.E. London and district, the Acting Hon. Secretary's address being 12, The Brent, Dartford, Kent. The Association is at present being entirely reorganised on lines more in keeping with its national character; the headquarters are to be shortly removed to London, and a general secretary will be appointed to give his whole time to the Association. The membership of the London area is now about 700, and new members are coming in daily. The London Hon. Secretary's address is 38, Craster Road, S.W. 2, to whom inquiries should be addressed.

Association of Mining Electrical Engineers.—The annual meeting of the North of England Branch of the Association was held in Newcastle-upon-Tyne, on Saturday last. Mr. Thos. H. Day, the hon. secretary, in his report stated that the war had greatly hampered their work, but interest in the Association was reviving now, and they expected a good year ; there were 140 members in the district. In his financial report, Mr. Day said that not only was there a credit balance for the year, but there was in hand and invested practically £70. The election of officers resulted as follows :— President, Mr. C. A. Nelson (Wallsend and Hebburn Collieries) ; vice-presidents, Messrs. J. P. Foster (Lecholme) and S. A. Simon (Blackhill) ; secretary and treasurer, Thos. H. Day (Benton).

Perth Electricity Employes : Wages Award.—From a newspaper report that has been sent to us we gather that Sir Richard Lodge, of Edinburgh, recently heard the case of the Perth Corporation electricity works employés, and he has now given his award. Representatives of the undertaking and of the employés stated the points at issue. The advances awarded (to be paid from October 1st, 1917) are as follows :—Mains engineer, 5s. per week ; shift engineers, 5s. per week ; switchboard attendants, 3s. per week ; fitters, 2s. per week ; fitter's mate, 4s. per week ; driver, 5s. per week ; firemen, 7s. per week ; jointer, 7s. per week.

Australian Metal Co. and the A.E.G.—We notice in the list of creditors in the winding up of the Australian Metal Co., Ltd., the following entries :—

Allgemeine Elektricitäts Gesellschaft, Berlin, £12,641, £16,230, and £1,476.

Electroculture.—Engineers and others who are endeavouring to interest agriculturists, &c., in electrocultural work, will be interested to know that Mr. W. T. Kerr, city electrical engineer, of Hereford, has had a series of lantern slides of electroculture installations prepared for lecturing purposes.

Apprenticeship in Electricity Supply.—In the course of correspondence recently, the engineer and manager of a small electricity supply system gave us the following particulars of the system of training given to the apprentices under his charge :—

In the first place, we distinctly state that the apprentice is to be taught engineering in connection with our generating station work and distribution system, and do not profess to turn out an electrical engineer for any branch of the business.

Our apprentices are employed on generating station work and on distribution and wiring work on alternate weeks during their first year. The latter includes cooker, motor, and heater installation and maintenance.

On meter testing, installation testing, and suchlike work in their second year.

During their third year they are employed in the office, where they learn book-keeping, stock-keeping, estimating, and mains map and record keeping, &c.

During the last six months they are paid a commission on all new connections canvassed for by them, in addition to a small wage.

We continue them in our employment at 30s. per week, plus this commission, when they are out of their apprenticeship.

Our wiring contracts are not large, the maximum at the present unsettled time being about £50, two or three of which we obtain each year together with numerous small contracts.

We have modern instruments for mains and meter testing, do our own calibration and repair of the latter, and carry out all our own mechanical repairs. Our book-keeping system is as modern as a high-class auditor can keep it, and our distribution work is all carried out in as modern a manner as in most large plants.

The class of youth we take could not afford to take a mechanical apprenticeship, and if they could not get a start at a small outlay, they would have no choice of a livelihood beyond a shop assistant or trade.

Only two apprentices have completed with us to date. One was appointed assistant electrical engineer at a Government station at £150 per annum, and the second had the choice of two posts as improver, at 25s. per week. Both were less than two months completed when they left.

From the foregoing you will see that, although everything is on a small scale, all learned is up-to-date work, as far as my knowledge and experience can make it.

We have often been impressed with the advantages of apprenticeship in a small undertaking, whether it be a factory or a power station, as the learner has a far better chance of acquiring experience in all branches of the business than in a large organisation, except in those cases where a special scheme of instruction is in force ; and the system outlined by our correspondent appears to be admirably devised to attain the desired end.

The Decimal System.—In the House of Commons, on Wednesday, Dr. Addison informed Mr. King that the question of adopting a decimal system of weights, measures, and coinage was being considered by the Committee on Commercial Policy After the War.

Electricity in Aviation.—A big German bombing machine which lately landed in Holland was fitted with an electric installation driven by motor for the purpose of warming the aviator.—*Daily Telegraph.*

Appointment Vacant.—Assistant electrical engineer (£300), for the Government Railway Department, Gold Coast. See our advertisement pages to-day.

The Whitley Report and Industrial Unrest.—Mr. Neville Chamberlain, presiding, in Birmingham, at an address by Mr. Wilfrid Hill on "Industrial Unrest: Its Causes and the Solution," to the Birmingham Business Club, said that industrial unrest was nothing new; we had it before the war, and after the war we should be face to face with a great many problems under changed conditions which it would take all our statesmanship to solve. It was the business men, the managers, and the workpeople engaged in industry who best knew what were the difficulties and what were the possibilities. The proposals of the Whitley Commission were not going to satisfy everybody. Certain men who were frankly revolutionary in their aims would not accept an olive branch of any kind. There were, however, more moderate and more practical and sensible men, who were prepared to come to terms, if terms could be arranged of a reasonable character, and who were sincerely and patriotically anxious to promote the future prosperity of the country.

Mr. Wilfrid Hill, who is a member of the Reconstruction Committee on Relations between Employers and Employed, said that in the interests of the community it was high time that masters and men ceased fighting each other and became allies, joining their forces to fight the foreign foes of Britain's commercial supremacy. Competition abroad necessitated co-operation at home. The problem was to get rid of friction, and that could be accomplished by conciliation, not conflict. Realising this, the Government were engaged in an honest effort not only to investigate the causes of Labour unrest, but to facilitate and expedite their removal. With this object they had set up a Reconstruction Committee, which would make it its business to provide opportunities for employers and employed to meet and reason together. The proposals of the peacemakers, acting on behalf of the Government, were:—(1) A Workshop Committee in every factory, to be composed of representatives of the masters and workmen in equal numbers. They would meet fortnightly, in business hours. In the inital stages it was suggested that a representative of the Government should attend the meetings of these Committees in a purely advisory capacity. Next (2) there should be a Joint Industrial Council in every industrial district, to consist of representatives of the two sections in equal numbers, their meetings to be attended, for a time, at any rate, by a representative of the Government. These Local Committees would constitute a first court of appeal, to which grievances and knotty questions not satisfactorily settled by a Workshop Committee could be referred. They would also bring the firms of a district into closer touch, and substitute friendly co-operation for ruthless competition. Then (3) there should be a National Industrial Council composed of representatives of Employers' Federations and Trade Unions, in equal numbers. This would be a final court of appeal. It was not proposed at present to arm the National Council with power to enforce its decisions or to impose penalties. It would serve as an arbitrator, seeking to prevent quarrels between friends rather than to act as a judge pronouncing sentence on criminals. The triple organisation scheme of the Reconstruction Committee provided machinery which should make conciliation possible, and all that was needed was the good will of both employers and employed.—*Morning Post.*

Training of Disabled Soldiers.—Portsmouth Corporation is arranging to train disabled soldiers in mechanical, motor, and electrical engineering and acetylene welding.—*The Times.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Worcester T.C. has increased the salary of Mr. A. W. Powell, on his appointment as assistant engineer-in-charge at the electricity works, from £114 to £127 per annum; and that of Mr. H. Christopher, costs clerk, from £117 to £127 per annum.

General.—Sir Maurice Fitzmaurice, C.M.G., has been appointed to fill the vacancy on the Advisory Council of the Committee of the Privy Council for Scientific and Industrial Research, caused by the retirement, by rotation, of Mr. W. Duddell, C.B.E., F.R.S.

On October 11th, at Cardiff, Mr. J. G. Bomford, managing director of Messrs. Booth & Bomford, Ltd., electrical engineers, Cardiff, was married to Gladys, daughter of Mr. and Mrs. Walter Lewis, of Cardiff.

The *Indian Textile Journal* states that H.E. the Governor in Council has appointed Mr. T. G. Sullivan, temporary assistant electrical engineer, as electric inspector. Mr. Sullivan will be under the orders of the electrical engineer to the Government, and will exercise the powers and perform the functions of the electric inspector in the Bombay Presidency, excluding Sind.

Mr. T. E. Allan, of Lincoln, who has been connected with the management of Messrs. Robey & Co., Ltd., for several years, has been appointed to a seat on the board of the company.

Roll of Honour.—Gunner George Drake, R.F.A., formerly in the golf ball department of the India-Rubber Co., Silvertown, was awarded the Military Medal on September 28th. Private W. J. Balkwell, Bedford Regiment, formerly in the gutta-percha department of the same company, was very badly wounded in France recently.

Corporal C. C. J. Smith, formerly on the Maidstone Corporation tramway staff, is reported killed, after being missing since June 7th.

Lance-Corporal T. H. Andrews, who was in civil life electrical engineer at the Star Picture Theatre, Leicester, has died of wounds received in action.

The D.C.M. for gallantry has been awarded to Lance-Corporal J. H. Enticott, Oxford and Bucks Light Infantry, who was at the Rugby works of the B.T.H. Co. He had previously gained the Military Medal and bar.

Private A. W. Jacobs, City of London Fusiliers, who has fallen in action, was on the staff of Messrs. Johnson and Phillips, Ltd., Charlton.

The Military Medal for bravery has been awarded to Sergeant R. Bainbridge, R.G.A., who was on the York Corporation tramway staff.

Second-Lieutenant N. C. Whittall, Royal Fusiliers, attached to the R.F.C., who has been killed whilst flying in France, took his commission in June, 1915, whilst with Messrs. Elliott Bros., Ltd., Lewisham.

At Bolton, last week, the Mayor presented the D.C.M. to Lance-Corporal John Wharton, R.E. The award had been granted for services connected with the Intelligence Department of the Forces. Lance-Corporal Wharton was engaged as an electrician with Mr. James Morris, of Bolton.

Sapper R. M. Bond, R.E., who has been killed in action, was employed in the drawing office of Messrs. Dick, Kerr and Co., Ltd., Preston.

Corporal H. Thornton, R.E., reported wounded, was in the employ of Messrs. A. R. Farrer & Co., electrical engineers, Bradford.

Private F. Wilkinson, York and Lancaster Regiment, who has been killed by an enemy sniper, was an apprentice with Mr. V. Ferrand, electrician, Bingley.

Private W. Brown, an employé of Messrs. Kennedy, Stark and Co., electricians, of Glasgow and Paisley, has been awarded the Military Medal.

Private J. Anderson, formerly an apprentice wireman in the Glasgow Corporation electricity department, has been killed in action.

Acting Corporal-of-Horse A. E. Jackson, killed in action, was employed by the Electric & Ordnance Accessories Co., at Aston.

Corporal H. Booth, of the Royal Welsh Fusiliers, killed in action, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Lance-Corporal J. Walmsley, Loyal North Lancashire Regiment, who gained the Military Medal in July, has been killed in action, aged 32. He was employed by Messrs. Dick, Kerr and Co., Ltd., Preston.

Obituary.—Mr. W. R. Sykes.—We regret to record the death, which occurred on October 2nd, of Mr. W. R. Sykes, of railway signalling fame. He was the inventor of the lock-and-block signal, and some 18 years ago formed the W. R. Sykes Interlocking Signal Co. He was connected with the electrical and other signalling work on a large number of railways. Mr. Sykes was 77 years of age.

Mr. R. Brocklebank.—The death has taken place of Mr. Robert Brocklebank, Llandudno, who was on the staff of Messrs. Lance & Co., electricians, and formerly secretary to the Chester Engineering Co., Ltd. He was in his 61st year.

Herr R. O. Heinrich.—The death is reported from Berlin of Herr R. O. Heinrich, the director of the Weston Instrument Co., of that city.

Will.—Mr. F. O. Erichsen, A.M.Inst.C.E., director of Messrs. James Simpson & Co., Ltd., engineers, left £8,806.

NEW COMPANIES REGISTERED.

Grosvenor Engineering Works, Ltd. (148,632).—Private company. Registered October 8th. Capital, £2,000 in £1 shares (1,900 7 per cent. cum. pref.). To carry on the business of electrical engineers and contractors, makers of and dealers in munitions, submarines, aeroplanes, aircraft, and components, agricultural implements, boilers, &c. The subscribers (each with one ord. share) are:—R. J. Murray, Merton Grange, Milner Road, Bournemouth, engineer; A. E. Morgan, The Pines, Penn Hill, Avenue, Parkstone, Dorset, motor engineer. The first directors are: R. P. Murray and A. E. Morgan. Secretary: C. Sutton. Registered office: The office of the Grosvenor Garage (Bournemouth), Ltd., Poole Hill, Bournemouth.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Creed & Co., Ltd.—Satisfaction in full (a) on April 26th, 1917, of debentures dated October 3rd, 1912, securing £3,525, and (b) on August 16th, 1917, of two mortgages (one collateral) dated February 4th, 1915, securing £1,500.

Torquay Tramways Co., Ltd.—Memorandum of satisfaction to the extent of £900 on September 28th, 1917, of charge dated March 8th, 1911, securing £60,000 has been filed.

Birmingham and District Power & Traction Co., Ltd. (19,077).—Capital, £700,000 in £1 shares (250,000 pref.). Return dated June 25th, 1917. 146,846 pref. and 412,934 ord. taken up; £559,780 paid. Mortgages and charges: £394,433.

Bat Meter Co., Ltd. (99,327).—Capital, £20,000 in £1 shares (12,000 pref.). Return dated August 24th, 1917. 10,683 pref. and 8,000 ord. taken up; £1 per share called up on 423 pref., and 15s. per share on 10,260 pref.; £8,118 paid; £8,000 considered as paid on 8,000 ord. Mortgages and charges: Nil.

Llangollen and District Electric Light & Power Co., Ltd.—Debenture dated September 20th, 1917, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: T. O. Sockleston and H. Wilson, 3, Tithebarn Street, Liverpool.

Notable Electric Co., Ltd.—Particulars of £2,000 debentures created September 14th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

General Cable Manufacturing Co., Ltd.—Memorandum of satisfaction in full on July 26th, 1916, of debenture dated June 24th, 1915, securing £1,000, has been filed.

CITY NOTES.

Eastern Extension, Australasia, and China Telegraph Co., Ltd.

The report for 1916 states that the gross receipts amounted to £1,221,497, against £950,090 for the previous year. The working expenses, including £74,608 for the maintenance of cables, absorbed £430,244, against £386,672 for the previous year., leaving £791,253, plus £38,816 brought forward. From the balance £246,853 was provided for income-tax and excess profits duty payable in England, and £30,096 for the interest on the mortgage debenture stock, leaving £553,121, out of which four dividends of 1½ per cent. each and a bonus of 2 per cent., amounting together to £240,000, were paid, making a total distribution for the year 1916 of 8 per cent., free of income-tax. The balance of £313,121 has been disposed of by transferring £250,000 to the general reserve fund, and carrying forward £63,121 to the next account. The agreement entered into by the French Government with the company in 1884, for providing and maintaining under a subsidy arrangement cable communication between Cochin China and Tonquin having expired, the cable has been sold and transferred to the Government. After crediting capital expenditure with the cost of the cable (£121,455), which was originally debited to that account, the loss resulting from the transaction, amounting to £66,154, has been debited to the general reserve fund. Under arrangements made with the Governments of the Australian Commonwealth and New Zealand, the company's cable stations at La Perouse (near Sydney) and Wakapuaka (near Nelson) have been closed, and its cables between Australia and New Zealand extended to Wellington, where they are now being worked direct with Sydney under greatly improved conditions. The cost of the extensions and partial renewals of the cables will be debited to the general reserve fund in the current year's accounts.—*Financial Times.*

Eastern Telegraph Co., Ltd.

The report for 1916, now issued, shows that the revenue was £2,519,283, less £707,038 for ordinary expenses and £352,905 for expenditure relating to maintenance of cables, income-tax payable abroad, and special war payments to staff and other expenses in connection with the war, leaving £1,459,340, plus £26,638 brought forward. After providing for income-tax and excess profits duty payable in England, interest on mortgage debenture stock, and preference dividends, absorbing £596,290, the balance is £889,688, out of which £500,000 has been placed to general reserve, £10,000 to insurance of war risk at stations fund, and £5,000 to insurance of goods in transit fund. The total distribution for the year 1916 is 8 per cent., free of income-tax, leaving £54,688 to carry forward. The general reserve fund has been charged with £11,951 in respect of loss on sale and redemption of investments and certain special expenditure, and with £150,000 as a further provision on account of investment fluctuations. After crediting the above £500,000, the net addition to the fund for the year is £338,049. The vacancy on the board caused by the death of Lord Allerton has been filled by the appointment of Sir R. M. Kindersley, K.B.E.

German Companies.

The Elektrotechnische Fabrik Rheydt Max Schorch & Co., A.G., of Rheydt, whose operations are now chiefly devoted to the production of war material, reports gross profits of £40,000 for the first half of 1917, as compared with £49,000 in the whole of last year. After making provision for depreciation, the net profits and large balance forward are returned at £45,000, as against £40,000 in 1916, the dividend being 10 per cent. for the six months, as contrasted with 15 per cent. in 1916.

The Elektrizitats A.G. vorm. H. Poge, of Chemnitz, reports a substantial increase in the turnover in 1916-17, and an advance in the net profits from £88,000 in 1915-16 to £127,000 last year. It is proposed to pay a dividend of 20 per cent., as compared with a rate of 15 per cent. in 1915-16. The share capital is to be raised by £75,000 to £300,000 for the extension of the works and the provision of additional working capital.

The Gasgluhlicht Gesellschaft (Auer), of Berlin, records a turnover, including war materials, three times greater in 1916-17 than in the most favourable year of peace. The net profits are £717,000, as against £500,000 in 1915-16. It is proposed to distribute 25 per cent. on ordinary shares for £396,000, as in the previous year, and 5 per cent. on preference capital for £440,000, and to devote £106,000 to the repurchase of a further block of preference shares for cancellation.

The directors of the *Kabelwerk Rheydt A.G., of Rheydt*, after appropriating only £1,100 for depreciation in 1916-17, as contrasted with £61,000 in the previous year, report net profits of £221,000, as against £184,000 in 1915-16. It is intended to pay a dividend of 20 per cent., as compared with 30 per cent., in the form of the allocation of the divisible amount to the payment of a first instalment of 50 per cent. on a proposed share capital increase by £100,000 to £350,000, whilst the remaining half will be called up at a subsequent date.

The financial statement of the *Elektrowerke A.G., of Berlin*, the ownership of which has now been transferred to the Imperial Government, shows a loss of £2,100 in 1916-17, which follows a loss of practically the same amount in the preceding year. Although the undertaking only has a share capital of £250,000, advances of a total of £2,000,000 were made by the A.E.G. and the Berlin Electricity Works Co., and the taking over of the entire undertaking by the State has been accompanied by the substitution of State directors in place of the private representatives.

The report of the *Brandenburg Carbid und Elektrizitats Werke A.G., of Berlin*, states that the company's water powers were being fully utilised, and the steam plant had to be worked to a greater extent in order to meet the demand for energy. The working results, which apply to the year ended on March 31st, 1917, were unfavourably affected by the scarcity of labour and the difficulties in procuring supplies of raw materials. In the autumn of 1916 the sale of calcium carbide was brought under governmental control, and the prices thereby fixed left only a moderate profit. *The Norsk Elektrokemisk Aktieselskab* was again able to pay a dividend of 10 per cent. for 1916, although the water and transport conditions were unfavourable. The accounts of the Brandenburg Co. show net profits of £14,700, as contrasted with £14,400 in 1915-16, and a dividend of 7 per cent. is proposed, as in the previous year.

Montreal Light, Heat & Power Co., Ltd.—Dividend of 2 per cent. on the paid-up capital stock for the quarter to October 31st.

Anglo-Portuguese Telephone Co., Ltd.—Interim dividend of 3 per cent., less income-tax.

Kaministiquia Power Co.—Dividend at the rate of 7 per cent. per annum on the capital stock for the quarter to October 31st.

Fellows Magneto Co., Ltd.—The directors report that the value of the output in May was £4,384; in June, £5,350; and in July, £7,263. It is hoped that by the end of December the monthly output will exceed £14,000 in value. Additional capital expenditure since the company started trading amounts to £27,060. On August 31st the company's liquid funds amounted to £18,569. Treasury consent has been granted for a further issue of £40,000 in preferred shares, but a decision has not yet been come to as to when this issue will be made. The directors hope to be able to recommend an ordinary dividend with the final dividend on the preferred shares for the current year.

Tubes, Ltd.—The directors in their report refer with regret to the death of the chairman, Captain John Chamberlain, M.C., who was killed in France on May 14th of this year. This deplorable event made a reconstruction of the board desirable, and Mr. Arthur Chamberlain, J.P., and Mr. James Rollason, J.P., have accepted seats on the board. The directors are still unable to present the accounts for the years ended April 30th, 1916, and 1917. The shareholders will be asked to confirm the payment of the interim dividends made on December 23rd and July 25th last, which the directors are satisfied have been earned during the year ended April 30th, 1917.

Electric Supply Co. of Victoria, Ltd.—In their report for the year ended March 31st, 1917, the directors show that the lamps connected increased from 166,253 to 188,402, and the passengers carried from 4,877,325 to 4,803,895. The trading account shows a gross profit of £31,248, as against £30,702 for the previous year. The balance to credit of profit and loss account is £29,528, plus £6,433 brought forward. There has been paid for debenture interest £7,393, and transferred to debenture stock redemption account £6,892, leaving £21,677, out of which £5,250 is required to pay on account of arrears of preference dividend, and £16,427 is to be carried forward.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the five weeks ended August 31st, 1917, was 2,982,020, compared with 2,616,727 units in 1916.

Brisbane Electric Tramways Investment Co., Ltd.—Interim dividend, 8 per cent. per annum (4s. per share), free of tax, on ordinary shares for the half-year.

Calcutta Tramways Co., Ltd.—Interim dividend on the ordinary shares at the rate of 2½ per cent., free of tax.

Lima Light, Power & Tramways Co.—Dividend of 1¼ per cent., in Lima, on the shares.

Parsons Marine Steam Turbine Co., Ltd.—It has not been possible to complete the accounts for the year ended June 30th, 1916, nor for the year ended June 30th, 1917, but a dividend of 15 per cent., free of income-tax, payable on 17th inst., is recommended, making 25 per cent. for the year. No further dividend for the year will be declared.

National Telewriter Co., Ltd.—The report for the year ended June 30th states that the results of operations, owing to the decrease in business in consequence of the war, show a loss of £240, as compared with a profit of £1,020 for the previous year.—*Financial Times.*

Lancashire Dynamo & Motor Co., Ltd.—Dividend of 5 per cent. (actual) on the ordinary shares, free of tax.

United River Plate Telephone Co., Ltd.—Interim dividend of 3 per cent. (3s. per share) on the ordinary share capital, free of income tax, for the half-year to June 30th.

STOCKS AND SHARES.

Tuesday Evening.

The strength of the investment markets continues with little abatement. The news from the Western Front is helping markets generally, and the publication of the results so far achieved with the issue of the new War Bonds is regarded with considerable satisfaction. Russian news is, of course, disappointing, although it is thought that this will have comparatively slight effect upon the course of the war. Money remains reasonably cheap. There is a strong demand for investment securities of all kinds, but some of the home railway stocks underwent a trifling reaction after their previous rises.

Metropolitan Consolidated has risen ¾ on the week, and the Deferred dividend stock hardened to 22, while there has been a little business in Surplus Lands on the basis of 48. Districts are unchanged at 16½, and in the Underground issues, the Income bonds have risen to 84, the £10 shares being still quoted 1⅛ and the 1s. shares at 6s. 3d.

Home electricity shares are as firm as ever. Bromptons rose to 6⅛, changing hands the other day at 6 9/16, and the 7 per cent. Preference shares have been sold at 6½. City of London have advanced to 13, with business at 13 1/16, but Counties at 11 show a slight fall. London Electrics, although business was marked the other day at 15s., are not offered below £1. The company's 4 per cent. First Mortgage debenture stock changed hands on Monday at 82. Metropolitans hold their rise at 3½. St. James's are being dealt in round about 7, but are more easy to sell than they are to buy. In the case of the other shares, the principal difficulty is to get the offer of any reasonable quantity.

Victoria Falls Preference are being bought by the provinces, and the price shows a good deal of strength at 24s., the 5½ per cent. debentures being 105½, while the ordinary shares hold their previous price of 19s. South Wales Electric ordinary came to market the other day at a shilling.

In the foreign group, Anglo-Argentine Tramways first preference are down 1/16 to 3⅛, in consequence of the gravity of the strike situation. The Argentine Government, however, is apparently bent on strong measures for suppressing the trouble, and after a spasm of acute flatness, Argentine railway stocks recovered sharply, which had a sympathetic influence upon other industrials connected with the country. Brazil Tractions are a point lower at 45. There is little change from day to day in the course of the Rio exchange, and until the rate takes a distinct turn for the better, it is hardly likely that Brazilian securities will undergo improvement. Rio Tramway first mortgage bonds keep very hard, however, at 87½, and there has been a little business lately in the company's 5 per cent. mortgage bonds at or about 78¾. Mexican issues are quiet, a little undecided it may be, but attracting scarcely any active attention for the time being. Mexican Light and Power Preferred 7 per cent. Preference was done the other day at 34; the company's deposit receipts for the bonds stand a trifle higher than the actual bonds themselves. Mexican Northern Power Gold bonds, nominally 10-14, were negotiated this week at 12½, and Monterey Fives at 27. Canadian industrials remain depressed.

The telegraph list is very steady. A lot of business is being done in the Marconi issues. Eastern Extension shares were ex 3s. dividend last Thursday, and Eastern Telegraph stock ex 30s. No changes, however, have been made in the prices, and this applies also to Cuba Submarine Telegraph, the dividend in the last named being 5s. a share. Cuba 10 per cent. Preference, by the way, are quoted at 14½, which is £2 lower than at the outbreak of war, although the ordinary at 8¾ are 5s. higher. Eastern Telegraph ordinary stock, incidentally, is 18 points higher than it was at the end of July, 1914. Great Northern maintain their rise at 39. West India and Panama shares receded to 30s., though there is not much business doing in them. Marconis have risen to 3½, but the feature of the week is the strength and activity of the market in American Marconis about 22s. 3d. and Canadian Marconis at 12s. A strong Stock Exchange tip was circulated to buy the former on the strength of vague statements as to the remarkable prosperity which the American Marconi Co. is enjoying, and a good many speculators helped themselves to shares. A bit of a bull account in them was built up, and at 23s. 9d. shares came in freely. Canadians have been a dark market for some time past, and the rise is due to sympathy with the advance in American Marconis. Marconi Marines are very firm at 52s. 3d., and the preference shares of the parent company keep about 2 15/16.

British Insulated ordinary are the main feature of strength amongst industrials, the price putting on 15s. to 14½. India-Rubbers gained 5s. to 14, and General Electrics of both classes have gone ahead, the ordinary to 17½ and the preference to 10½. Babcock & Wilcox have recovered to 3½. Edisons are easier at 20s. 6d., interest having died out in them for the time being, and British Westinghouse preference eased off to 3.

The rubber market has been somewhat upset by a sharp break in the price of some of the Java shares, due to the situation that has arisen between this country and Holland. Moreover, the price of the material shows dulness at 2s. 7½d. per lb. Nevertheless, there is a considerable amount of business going on. Iron, coal, and steel shares are strong, and in some of the markets connected with the baser metals, more particularly for that of copper, rather more activity has developed, though without much change in prices. The Stock Exchange as a whole is actively employed, and the tone throughout the markets keeps distinctly good.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Oct. 16, 1917.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	6⅞	+ ⅛	£5 15 1
Charing Cross Ordinary	5	5	8⅝	—	6 9
do. do. do. 4½ Pref.	4½	4½	8¾	—	6 18
Chelsea	4	3	2⅞	—	5 9
City of London	8	8	13	+ ⅛	6 3 3
do. do. 6 per cent. Pref.	6	6	10½	—	5 18
County of London	7	7	11	— ⅛	6 7
do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	6	6½	—	5 14 3
London Electric	3	3	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8¾	—	5 6 8
Metropolitan	3	3	3½	—	4 13 4
do. 4½ per cent. Pref.	4½	4½	6¼	—	7 4 8
St. James' and Pall Mall	8	8	7	—	6 14 6
South London	5	5	7⅞	—	7 5 6
South Metropolitan Pref.	7	7	21/8	—	6 10 7
Westminster Ordinary	7	7	6⅞	—	5 3 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	9⅞	—	6 1 0
do. Def.	33/6	1½	2¾	+ ⅛	6 9 0
Chile Telephone	8	8	7⅞	—	5 11 4
Cuba Sub. Ord.	5	5	8⅞	—	5 14 3
Eastern Extension	8	8	14⅛ xd	+3/-	*5 8 4
Eastern Tel. Ord.	8	8	148½ xd	+1½	*5 7 9
Globe Tel. and T. Ord.	7	7	18½	+ ⅛	*5 6 8
do. Pref.	6	6	10⅜	—	5 15 8
Great Northern Tel.	22	24	39	—	6 3 1
Indo-European	13	13	53½	—	6 1 6
Marconi	16	16	3½	+ ⅛	4 5 9
Oriental Telephone Ord.	10	10	3⅛	—	3 1 6
United R. Plate Tel.	8	8	6¼	—	*5 16 4
West India and Pan.	6d.	6d.	1⅛	— ⅛	3 6 8
Western Telegraph	8	8	14⅜	—	*5 10 4
Home Rails.					
Central London, Ord. Assented	4	4	60½	—	6 12 3
Metropolitan	1	1	34¼	+ ⅜	4 1 8
do. District	Nil	Nil	16⅛	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	—	Nil
do. do. "A"	Nil	Nil	6/8	—	Nil
do. do. Income	6	4	84	—	4 15 3
Foreign Trams, &c.					
	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	47	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	8⅜	— ⅛	6 16 0
do. 2nd Pref.	5½	—	2⅜	—	—
do. 5 Deb.	5	5	67⅜	—	7 8 3
Brazil Tractions	4	4	45	—1	—
Bombay Electric Pref.	6	6	92	—	6 4 8
British Columbia Elec. Ry. Pfds.	6	5	40½	—	12 4 10
do. do. Preferred	Nil	Nil	30	—	Nil
do. do. Deferred	Nil	Nil	27½	—	Nil
do. do. Deb.	4½	4½	50	—	8 10 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	46¼	—	Nil
do. 6 per cent. Bonds	Nil	Nil	40	—	Nil
Mexican Light Common	Nil	Nil	52¼	—	Nil
do. Pref.	Nil	Nil	85	—	Nil
do. 1st Bonds	Nil	Nil	45½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3½	+ ⅛	4 12 4
British Aluminium Ord.	7	10	13	—	6 3 1
British Insulated Ord.	17½	20	14½	+ ⅜	6 15 7
British Westinghouse Pref.	7½	7½	3	— ⅛	5 0 0
Callenders	20	20	144	—	6 18 0
do. 5 Pref.	5	5	4½	—	6 1 8
Castner-Kellner	22	22	5⅞	—	6 8 0
Edison Swan, fully paid	—	—	1⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	72½	—	5 10 4
Electric Construction	7½	7½	1	—	7 10 0
Gen. Elec. Pref.	6	6	103	+ ⅛	5 14 3
do. Ord.	10	10	17½	+ ⅜	5 12 0
Henley	25	25	10½	—	7 18 8
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	14	+ ½	*7 2 10
Telegraph Con.	20	20	40	+1	*5 0 6

* Dividends paid free of income-tax.

THE HIGH-TENSION MAGNETO.*

(*Continued from page* 335.)

The special "spark-gap" distributor is used in the type "A" magneto, and has proved to be thoroughly reliable and satisfactory. The distributor brush is made of steel, and has V grooves in its active face with a central slot for taking the square head of the locking screw. It is of rectangular section, and is free to move in a brass tube moulded into the insulation. A spring forces the brush outwards against the head of the locking screw. Obviously, the screw is automatically locked, and the air gap between the face of the brush and the track of the distributor can be readily adjusted by first depressing the brush until the head of the screw is clear and then turning the latter either one way or the other. A quarter of a turn on the screw, which gives the minimum adjustment, alters the air gap by 0.002 in. When properly adjusted, the air gap should be between .01 in. and .014 in. The amount of wear on the face of the brush after continuous use is so small as to be almost negligible.

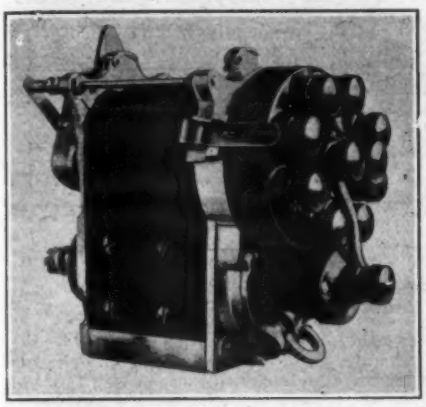

Fig. 14.—The B.T.H. Type A 8 S Magneto.

It does not seem to be generally appreciated that the manufacture of magnetos can only be undertaken successfully if very skilled labour is available, and the necessary steps are taken to machine all the component parts to extremely fine limits. The type "A" magneto is so complicated in design that the difficulties encountered in manufacturing it on a commercial basis are, without doubt, much greater than in the case of any other type of magneto being produced in England at the present time.

Take, for example, the rotating sleeve inductor. It comprises two soft iron segments which are secured by means of screws and dowel pins to a non-magnetic nickel steel end plate and spindle on the one hand, and to a gun-metal end plate carrying the distributor gear-wheel driving pinion on the other. The whole combination has to run on three ball bearings, all of which must be in perfect alignment. The outer race of one bearing is carried by the aluminium driving end plate, whilst the inner races of the other two are securely fixed to the respective ends of the stationary armature end-plates. The clearance on each side of the sleeve inductor is only 0.006 in., and it is clear, therefore, that extraordinary precautions must be taken in manufacture to ensure that after assembly the sleeve will be perfectly free, and neither too tight nor too loose in its bearings.

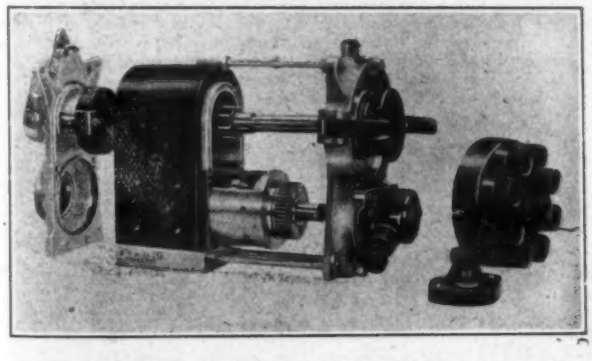

Fig. 15.—Parts of the A 8 S Magneto.

In the manufacture of the type "A" magneto no fewer than 716 limit gauges are employed; 179 gauges constitute one complete set, and four sets of gauges are in use, being allocated respectively to shop use, shop inspectors, Government inspectors, and check purposes in the tool-room. The shop gauges are made to somewhat finer limits than are specified on the drawing, so that the rejections made by the inspection department are reduced to an absolute minimum. The finer limit gauges are checked in the tool-room every day, whilst other gauges are checked periodically, the frequency of the inspection being dependent upon the degree of accuracy worked to and the liability of the gauge to wear in use. When the "go" end of a gauge (which is made somewhat larger than the minimum diameter specified) has worn down to the drawing dimension, the gauge is passed on to the inspectors for use in inspecting the work. This arrangement ensures that there is always an ample supply of very accurate gauges in the inspection department, because the wear on gauges used in the shops is much more rapid than the wear from use by the inspectors. Furthermore, each gauge has, by this method of working, a more extended life. Gauges are withdrawn from the inspection department for very slight errors from drawing dimensions, and the cost of maintaining a large number of gauges within narrow limits of accuracy is naturally quite a considerable item.

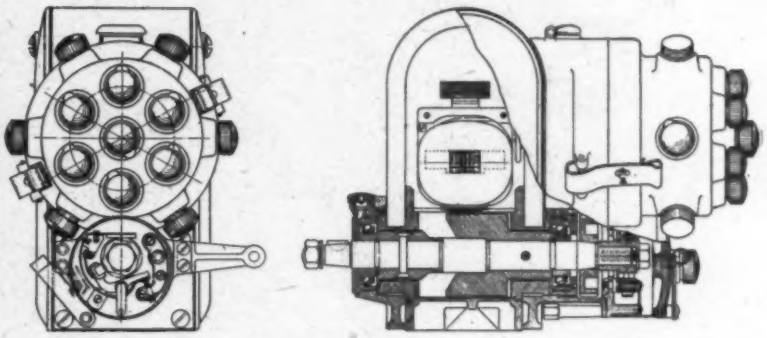

Fig. 16.—Assembly of B.T.H. 12-cylinder Polar Inductor Type Magneto.

The finest limits worked to are for the hole in the contact-breaker cam and the end of the distributor brush spindle, on which the cam is fitted. These limits are:—

Hole in cam ...	Maximum diameter ...	13.005 mm.
	Minimum diameter ...	12.995 mm.
	Tolerance ...	0.01 mm.
End of spindle ...	Maximum diameter ...	12.995 mm.
	Minimum diameter ...	12.988 mm.
	Tolerance ...	0.007 mm.

The B.T.H. Co. has recently developed a polar inductor type magneto, more especially for 12-cylinder working, although it is proposed to standardise an 8-cylinder machine of exactly the same design by simply changing the distributing mechanism and gearing. This is the first 12-cylinder magneto to be developed and standardised in this country. Several models have already been constructed and tested with entirely satisfactory results on engines in the test shop, as well as in the air. It is designed to give four sparks per revolution, and the 12-cylinder model runs at 1½ times engine speed.

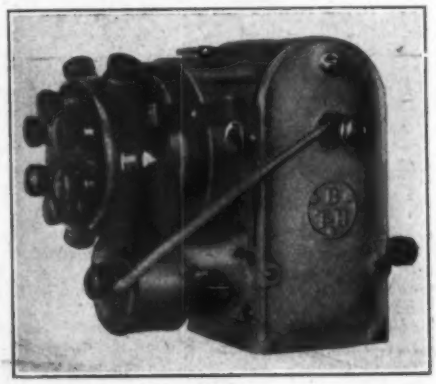

Fig. 17.—B.T.H. Polar Inductor Type Magneto.

The basic principle embodied in this design of producing the requisite flux reversals in a stationary laminated armature circuit, by means of a rotating polar inductor co-operating with fixed permanent magnets, is a British invention made by Mr. T. B. Murray, of the Albion Motor Car Co., and first disclosed by him in patent specification No. 14,737, dated June 28th, 1906. This patent is now void.

This magneto is inherently of much simpler construction than the sleeve inductor machine, because the sleeve inductor,

* Abstract of paper read by Mr. A. P. Young, A.M.I.E.E., before the Aeronautical Society.

which is a very difficult part to manufacture, is replaced by a polar inductor so designed that it can be easily made, and which at the same time is a more rigid and reliable mechanical structure. Other features in the design combine greatly to simplify the manufacturing problems, and it is anticipated that, other things being equal, the output of magnetos will rise very considerably after the change over from one type to the other has been completely effected—a fact of vital importance at the present critical juncture.

A sectional view of the machine is given in fig. 16. The polar inductor consists of a "straight-through" shaft made of non-magnetic nickel steel, on to which two polar inductors are first pressed up against a shoulder, and then finally riveted in position to the shaft. The ends of the magnets are secured to two soft-iron pole-pieces, near the top of each, by means of screws. There is an extremely fine air gap between

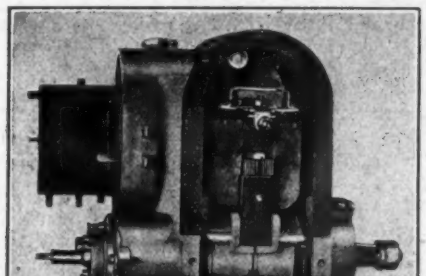

Fig. 18.—Component Parts of Polar Inductor Magneto.

the inside face of each pole piece and the outside surface of the annular portion of the inductor which it surrounds.

The magnet flux, therefore, passes through this fine annular air gap in a radial direction, and flows from one inductor to the other through the laminated armature circuit. The armature windings are carried by a brass spool, which is secured to a laminated iron core, which, in turn, is fixed by means of two clamping screws to two upright laminated projections. These are fixed in the central casting which carries the pole pieces, and also provides the base of the machine.

The contact breaker is operated by a four-part cam fixed to the end of the driving shaft. The contact breaker lever is specially designed so as to give a very low moment of inertia, and tests have shown that it will function satisfactorily when making 16,000 breaks per minute. This frequency corresponds to a speed of 4,000 r.p.m.

The distributor is of special design, having three distinct

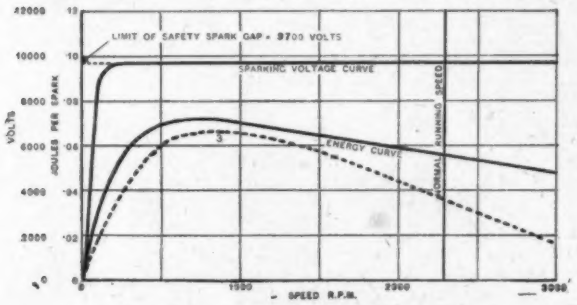

Fig. 19.—Sparking Voltage and Energy Curves.

tracks, two of which are the distributing tracks, each provided with six segments. The brush-holder contains five carbon brushes, and the safety gap is incorporated in the brush-holder and rotates with it. A gauze window is provided in the front of the distributor, and in consequence of the rotation of the brush-holder any products of ionisation have an easy chance of escape. This arrangement is much to be preferred to a totally enclosed stationary type of safety gap, where the silent brush discharge is always liable to produce injurious results.

A good idea of the general appearance of this magneto can be formed by referring to fig. 17, which gives an outside view of the machine, while the component parts are clearly depicted in fig. 18.

The magneto possesses excellent sparking characteristics at low speeds, as shown by the curve in fig. 19, which has been plotted from results of an actual test. The energy output, although not abnormally high, is very satisfactory for an inductor-type magneto. The curve plotted from the figures obtained by a calorimeter test is also given in fig. 19.

It should be noted that the maximum energy output, which is reached at a speed of about 800 r.p.m., is as large as .072 joule.

Special precautions have been taken in the design of the magnetic circuit as well as in the choice of suitable magnetic material to ensure that the effect of eddy-current damping is reduced to an absolute minimum. As a result of this, the falling-off in the energy output as the speed is increased beyond the maximum point on the curve is not very marked, and for the sake of comparison curve 3 (shown dotted), which has been plotted from the figures obtained on testing a 12-cylinder polar inductor-type magneto of American manufacture, is added. In this case the effect of eddy-current damping at high speeds is very pronounced indeed, and the energy output, which reaches a maximum of .065 joule at about 800 r.p.m., falls away to only .015 joule at 3,000 r.p.m. There is no doubt that by paying more careful attention to the design of the magnetic circuit as referred to above the characteristic of this particular magneto, so far as energy output is concerned, could be improved.

Fig. 20 shows two curves, one giving the variation in the open-circuit primary voltage (R.M.S. value) with the speed and the other the variation in the short-circuit primary-current

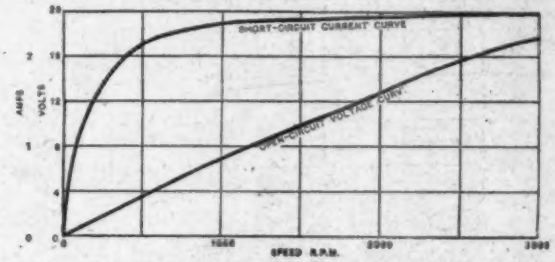

Fig. 20.—Short-circuit Current and Open-circuit Voltage Curves.

(R.M.S. value) corresponding to the same range of speed. The open-circuit voltage curve is practically a straight line passing through the origin, which confirms the view that the eddy-current damping in the magnetic circuit is extremely small. With most types of magnetos the open-circuit primary-voltage curve shows a distinct drop with increase in speed, due to the fact that the active armature core flux diminishes as the speed is raised. This drop is fairly pronounced in the case of the sleeve inductor-type magneto already described, as shown by the open-circuit voltage curve given in fig. 11.

The short-circuit current, on the other hand, remains substantially constant for all speeds above about 600 r.p.m., and this test, in which the magneto is run with the primary short-circuited through an ammeter of negligible resistance, is analogous to the case of an alternator running on short circuit. Every electrical engineer knows that in the latter case the short-circuit current is practically independent of the speed, due to the fact that the induced e.m.f. in the short-circuited winding varies in almost strict proportion to the reactance of the winding.

The primary voltage kick at the instant of "break" was determined at different speeds by using a Kenotron in conformity with the method of testing previously referred to. The voltage increased with the speed up to 3,000 r.p.m., very rapidly at first, but not so rapidly at very high speeds. Abnormally high voltages were measured, these being considerably in excess of any figures that the author has been able to obtain by testing in the same manner any rotating armature type of magneto. When the ratio between the primary and secondary turns is taken into consideration, one is led to the conclusion that at the instant when the high-tension spark is initiated an abnormally high voltage is induced in the secondary, this voltage being greatly in excess of any figure that has been previously assumed.

The input, output, and efficiency curves are given in fig. 21. The input curve has been plotted from the values of the power

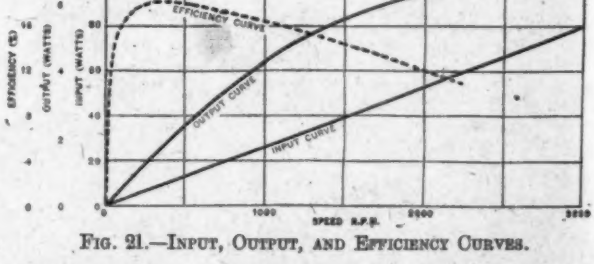

Fig. 21.—Input, Output, and Efficiency Curves.

required to drive the magneto at different speeds as measured by an electrical method, while the output curve is calculated from the spark energy curve given in fig. 19. The efficiency curve has been calculated in the usual manner, and is substantially in agreement with the curve for the type "A" magneto given in fig. 13.

(To be continued.)

A MAGNETIC STEEL BAND DRIVE.

By P. L. WESTON.

(*Abstract of paper read before the* Electrical Association of Australia, N.S.W. Section.)

Experiments made by the author in 1908 showed that magnetic pulleys could be devised which would efficiently attract steel bands as thin as 0.03 in. In 1916 he resumed the experiments, and found that good magnetic adhesion could be obtained with band thicknesses of 0.015 in. and upwards. The pulleys were 9 in. in diameter, and contained a single magnetic circuit, formed by two disks 25 mils thick with a winding space 1.75 in. deep and 40 mils wide, the current being led in through slip-rings. The total face of the pulley was 90 mils wide, and brass checks were provided. The band was ¼ in. wide and 15 mils thick. The pulley centres were 20 in. apart, and the pulleys were run at 1,500 r.p.m. for 300 hours, with a net difference of tensions of 20 lb. Slip took place when the difference of tensions was 45 to 50 lb., with 60 ampere-turns excitation, representing 5 watts for each pulley, and the tension in the slack side practically zero. The coefficient of friction was 0.265, and there was no appreciable wear on the band or pulleys. Up to 47 lb. difference of tensions the measured slip was almost identical with the normal calculated creep of the band due to stretching of the driving side of the band.

In another experiment, driving from a 10-in. pulley on a steam turbine to a 27-in. pulley at 29-in. centres, width of active face of pulley 80 mils, a band ¼ in. wide and 20 mils thick transmitted up to 20 h.p. at a turbine speed of 4,200 r.p.m., corresponding to a difference of tensions of 60 lb. The excitation of the small pulley was 50 ampere-turns, and that of the large pulley 12, the total power consumed being 25 watts.

The author discusses the theory of the drive, and shows for a 15-mil band on a 10-in. pulley, with an arc of contact of 150 deg., and a slack side tension of 50 lb., the maximum difference of tensions will be about 400 lb. A normal working value would be 250 lb., making the bending stress 45,000 lb. per sq. in., and the direct stress 20,000 lb. per sq. in. Advantages are gained by using thicker bands. For bands of ordinary band-saw steel with silver-soldered joints, if the ratio of band thicknesses to pulley diameter does not exceed 1/1,000, a life of many millions of bends may be expected. For a 24-ft. band at a band speed of 10,000 ft. per minute, 40 million bends over the smaller pulley represent 1,600 hours' running; such a band 1 in. wide would transmit 50 b.h.p., and would cost, say, 10s., so that on a life of 1,000 hours the cost of band renewals would be insignificant, while power would be saved owing to the unusually high efficiency of the drive. The satisfactory endurance of band-saws with ordinary silver-soldered joints under very strenuous conditions leaves no doubt as to the endurance of similar steel bands for power purposes. For very high-class drives welded bands, or endless bands rolled from a solid ring of steel, might be worth while, and probably the best material would be an alloy such as chrome vanadium spring steel, which would have an extremely high elastic limit when rolled in such thin sections and suitably tempered.

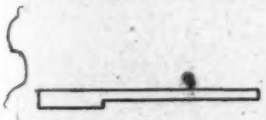

Fig. 1.—Section of Strip.

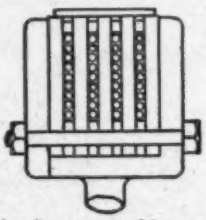

Fig. 2.—Section of Magnetic Pulley.

For the smaller pulley of a combination the construction adopted is virtually a double-threaded screw with rectangular threads of small pitch and relatively deep grooves, as shown in section in fig. 2. This construction could be readily made up of two helices of iron strip, of the section shown in fig. 1, rolled in conical rolls to the required pulley radius, and riveted together to form the pulley rim. In general, the pole thickness will be from twice to two and a half times the band thickness, and the winding spaces can be 40 to 50 mils wide and 0.7 to 1.5 in. deep. With these proportions 60 ampere-turns will usually give sufficient excitation, and the magnetising watts amount only to a small fraction of 1 per cent. of the power transmitted. For the larger pulley of a combination, owing to the longer arc of contact, the magnetic circuits can either be reduced in strength or more widely spaced. Fig. 3 shows a design in which the active poles are narrow zones of one polarity formed of iron disks or segments, alternating with wide zones of the opposite polarity. To increase the width of both N and S pole faces is inefficient, since the adhesion varies as the square of the flux density, and hence good attraction is secured only if the density of flux in the pole face is fairly high.

In a suitable design the sum of magnetising watts and the loss due to creep can be generally made from .2 to .5 per cent. of the transmitted power. Other losses comprise windage, hysteresis, and eddy currents, and increased friction of bearings. Hysteresis and eddy-current losses are found to be very small, and the remaining losses are almost negligible. It can be concluded, then, that an overall efficiency of well over 99 per cent. can be obtained, and 99.5 per cent. seems quite attainable.

Owing to the extremely small values of the slip, the rate of wear can only be quite small, as proved by test.

The band speed in general should be kept as high as possible, subject to the limitations of safe pulley design, to resist centrifugal force. At speeds over 10,000 ft. per minute for pulleys of small diameter, and above 15,000 ft. per minute for larger pulleys, the effect of centrifugal force in the band may have to be considered.

In the Eloesser drive, steel bands from 1 to 8 in. wide are run on cork-faced pulleys. The conditions laid down for successful working are (1) that the initial tension is to be as high as possible, without overstraining the band; and (2) that the pulley diameters are to be as large as possible.

The cork face is stated to give a value of $\mu = 0.28$, while a bare cast-iron pulley at first gave a value of 0.27, but afterwards was stated to become polished and gave a lower value. This polishing effect has not yet been found by the author in any of his tests to lower the value of μ.

While the Eloesser drive appeared to give in suitable cases very good results as regards capacity and efficiency, it seems to have failed in the matter of durability, being handicapped by a mechanical joint, which is bound to introduce local bending stress in the region of the joint where fracture will eventually occur. The only patentable part of this drive seems to be the joint, so it is obvious why the promoters of this drive did not discard a mechanical joint in favour of the well-tried band-saw joint, which has the great merit of preserving the uniform section of the band.

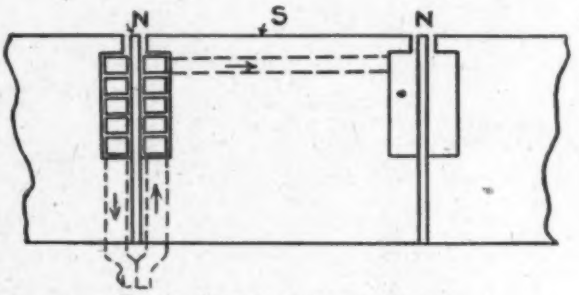

Fig. 3.—Section of Larger Pulley.

While the magnetic drive appears to have a very large scope of application, it is particularly suited to deal with a difficult class of heavy drives in which a fluctuating load has to be transmitted with a large reduction ratio. A typical example would be a large ammonia compressor, driven by a gas engine or electric motor. Take, for example, a 250-h.p. drive of this nature, for which, at present, rope driving would be the most frequent practice. Using 1¼-in. ropes, the usual rule of 30 diameters for the minimum size of pulley makes the smaller pulley not less than 45 in. Now, on a 45-in. magnetic pulley an 18 gauge band, 2 in. wide, will comfortably transmit the load at a linear speed of 5,000 ft. per minute. For the same speed and pulley diameters four 1¼-in. ropes, or a 21-in. double leather belt, would be required. The band would effect a saving on the length of drive of about 18 ft., and about 13 h.p. of losses as compared with the belt, and about 26 h.p. as compared with the rope drive.

In general, the large capacity, high efficiency, adaptability to high speeds and short centres, low first cost, and small slip of the band drive will suggest numerous applications of this form of transmission.

A number of problems in connection with this drive require investigation, and further tests are in progress. One interesting development is that by means of a simple attachment for measuring the creep of the band the power transmitted can be accurately ascertained.

Magneto v. Battery Ignition for Petrol Motor Vehicles.—It is interesting to learn from New York that, following a period in which battery ignition in conjunction with electric lighting and engine-starting sets has been so popular in motor-car manufacturing circles in the United States, there is now apparently a reversal of technical opinion on the subject, and present tendencies indicate a return to greater popularity of a separate magneto for ignition purposes.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE AND ALGERIA.—In pursuance of an agreement between the British and the French Governments, licences will be issued by the French Customs Office in London, upon application by the exporter in this country, for the importation into France and Algeria of goods of British production or manufacture which are included in the list of articles prohibited to be imported into those countries, with the exception of (*a*) goods included in List 3, published with the Decree of April 13th, and subsequently amended by the Decree of May 12th (c.f. the ELECTRICAL REVIEW of June 1st), which are placed under the control of the Inter-Departmental Commission on Metals and Munitions of War; and (*b*) certain specified goods (textiles, soap, oils, &c.).

In the case of goods falling under (*a*) and (*b*), applications for import licences must be made by the importers in France and Algeria to the competent French authorities, and information on the subject can be obtained by British exporters from the Board of Trade Office in Paris, No. 10, Place Edouard VII.

The following procedure has been laid down for the issue of French import licences in London for "prohibited" goods not of the excepted classes:—

The application for a licence must be drawn up strictly in accordance with the prescribed form, and be forwarded in triplicate *direct* to the French Customs Office, Bank Buildings, Kingsway, London, W.C. 2. To one of the three copies must be attached a separate certificate, signed on behalf of the Chamber of Commerce of the district or town in which the merchant concerned carries on his business, and attesting that the goods are the produce or manufacture of the United Kingdom.

[A copy of the prescribed form of application, and a suggested form of certificate of origin, were published in the *Board of Trade Journal* for September 13th. It should be borne in mind that the arrangements referred to above in no way affect the necessity of obtaining a British export licence in respect of such articles as are prohibited to be exported to those countries.]

A new Decree has been issued, which contains a re-classification of goods for the purposes of import prohibitions. Goods are now divided into seven categories, called respectively Lists A, B, C, D, E, F, and G. List A consists of those goods which are admitted without licence. In Lists B to G the goods are classified according to the authorities which are to advise as to the issue of import licences. The text of the various Lists may be consulted at the Department of Commercial Intelligence, 73, Basinghall Street, E.C. 2.

UNITED STATES OF AMERICA.—According to a Treasury Circular, trade samples intended solely for use in soliciting orders for goods may now be imported by ordinary mail in unsealed parcels, which, however, must be plainly marked abroad with the words "Trade samples of ....., subject to examination by United States Customs Officers." Samples sent on approval may not be sent in this way.

The exportation (except under licence) of various classes of goods has been prohibited by Proclamation. The list of goods includes wireless apparatus, electrical equipment, copper, lead, tin, nickel, aluminium, zinc, plumbago, and platinum.

ITALY.—The Italian Government has recently taken steps to terminate at the end of this year the various Treaties with foreign countries which fix rates of duty on certain classes of goods, thus leaving the Government free to revise the Tariff as may be found desirable. This revision has been under consideration by a Royal Commission, which is to present its report very shortly. The Commission has already issued important recommendations, which include the adoption of a double Customs Tariff, one with heavy duties on the goods of countries not granting favourable treatment to Italy, and the other with more moderate duties for goods of other countries. Anti-dumping legislation is recommended, and it is also suggested that the Customs *régime* of the Italian Colonies should be determined by special regulations.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

14,105. "Mine signalling apparatus." W. MILLAR. October 1st.
14,107. "Locking electrical spigot-and-socket unions." W. STEWART. October 1st. (Australia, November 10th, 1916.)
14,130. "Insulators for telephone, &c., wires." T. TAYLOR. October 1st.
14,165. "Audion or lamp relay or amplifying apparatus for wireless telegraphy, &c." M. LATOUR. October 1st. (France, September 30th, 1916.)
14,169. "Apparatus for preventing dead lines at line crossing or junctions on electric tramways." W. J. FENGE. October 1st.
14,171. "Thermostatic circuit closers." A. M. D. S. GREAVES. October 1st.
14,181. "Apparatus for use with searchlights." P. COWDREY. October 2nd.
14,187. "Electric hand-lamps." M. J. RAILING & T. TAYLOR. October 2nd.
14,194. "Electrolytic process to recover metal from scraps." E. POPPER. October 2nd.
14,197. "Electrical apparatus for internal-combustion engines." J. BIJUR. October 2nd. (U.S.A., November 24th, 1915.)
14,201. "Electric welding apparatus." R. F. WOODBURN. October 2nd.
14,210. "Automatic control of electrically-operated feed-reel brakes." H. V. JAMES. October 2nd.
14,215. "Electric furnace control apparatus." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) October 2nd.
14,254. "Telegraph, &c., signalling systems." T. B. DIXON. October 2nd.
14,286. "Process for electro-deposition of metals." A. A. LOCKWOOD. October 3rd.
14,309. "Electric storage batteries or accumulators." FULLER ACCUMULATOR Co. & J. C. WOOD. October 3rd.
14,335. "Method of depositing chromium electrolytically from its chemical salts single or compound." E. E. BURNETT. October 4th.
14,341. "Fusible metal, &c., cores or mandrels for electro-deposited metal tubes, &c." C. H. PARKER. October 4th.
14,348. "Magnetic separation of metals or magnetic bodies from oil flowing through oil circuits." D. BROWN & SONS AND W. H. CHILD. October 4th.
14,350. "Electric transforming and converting apparatus." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) October 4th.
14,360. "High-frequency spark gap." A. C. GUNSTONE & G. PEARCE. October 4th.
14,361. "Rectifier for mercury interrupters." A. C. GUNSTONE & G. PEARCE. October 4th.
14,369. "Electric motors." H. L. TANNER. October 4th. (U.S.A., July 19th, 1916.)
14,373. "Pocket flashlamps." C. S. CLOAKE & H. J. CLOAKE. October 4th.
14,392. "Fusible mandrels for copper, &c., electro-deposited tubes." LAMPLOUGH RADIATOR & ENGINEERING Co. October 5th.
14,393. "Incandescent electric lampholders." M. H. GOLDSTONE. October 5th.
14,399. "Electric torch apparatus." R. CUSHION. October 5th.
14,400. "Method of operating self-starters for motors propelled by internal-combustion engines." E. E. MORRIS. October 5th.
14,402. "Spark plugs." H. L. BOUDREAU & J. A. DE VILBISS. October 5th. (U.S.A., June 2nd.)
14,411. "Electrical transformers, &c." SIEMENS SCHUCKERTWERKE. October 5th. (Germany, December 2nd, 1916.)
14,412. "Localisation of faults in electrical conductors." J. E. TAYLOR. October 5th.
14,424. "Apparatus for detecting variations in magnetic fields." D. K. MORRIS. October 5th.
14,430. "Magneto-electric ignition apparatus." AKT. GES. BROWN, BOVERI ET CIE. October 5th. (Germany, October 31st, 1916.)
14,437. "Electric primary cells." R. PEARSON. October 5th.
14,446. "Electric motors." C. W. DURNFORD, AND SUBMERSIBLE & J. L. MOTORS, LTD. October 5th.
14,451. "Dynamo-electric machines." C. W. DURNFORD, AND SUBMERSIBLE AND J. L. MOTORS, LTD. October 5th.
14,455. "Electric pulley blocks." ELECTRIC PULLEY BLOCK Co. & H. B. SMITH. October 6th.
14,458. "Electromedical coils." M. H. GOLDSTONE. October 6th.
14,481. "Sparking plugs." J. COURTIER & P. COURTIER. October 6th. (France, October 7th, 1916.)
14,484. "Material for electric resistances, &c., and method of preparing same." J. INGER. October 6th.
14,493. "Incandescent electric lamps and lampholders." A. J. H. GURNEY. October 6th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1914.

14,439. PHONOGRAPHIC RESPONDING AND RECORDING DEVICES FOR USE WITH TELEPHONES. F. Seelau. June 30th, 1913.

1916.

8,473. MACHINE SWITCHING TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. & L. Polinkowsky. June 15th, 1916. (109,456.)
12,505. RADIO TRANSMITTER SYSTEMS. L. de Forest. September 4th, 1915. (101,415.)
12,687. ELECTRIC FURNACES. J. O. Boving. September 7th, 1916. Cognate application, 2,807/17.) (109,465.)
12,906. AUTOMATIC FORGING APPARATUS. A. W. Morris. September 12th, 1916. (109,475.)
13,121. CHARGING SYSTEMS FOR STORAGE BATTERIES. British Thomson-Houston Co. (General Electric Co., U.S.A.) September 15th, 1916. (109,485.)
13,181. SELENIUM AND LIKE SENSITIVE CELLS. M. Martinez. September 16th, 1916. (109,486.)
13,443. DYNAMO-ELECTRIC MACHINES. Anschutz & Co. September 22nd, 1915. (101,554.)
13,664. COMBINED ELECTRIC STOVES AND TOASTERS. H. A. Rice. September 22nd, 1915. (101,634.)
13,746. ELECTRIC SIGNALLING SYSTEMS. R. Lambourne. September 27th, 1916. (Cognate application, 1,233/17.) (109,325.)
14,698. MARINE PROPULSION. R. S. Portham. October 16th, 1916. (109,513.)
15,350. SPARK PLUG. M. C. E. Bundy. November 2nd, 1915. (102,054.)
16,008. METHOD OF AND PROCESS FOR MAKING MAGNETIC MATERIAL. British Thomson-Houston Co. (General Electric Co., U.S.A. November 8th, 1916. (109,528.)
16,855. METHOD OF AND MEANS FOR COOLING THE SPARKING PLUGS OF INTERNAL-COMBUSTION ENGINES. A. E. Lamkin. November 24th, 1916. (109,345.)
17,034. APPARATUS FOR AUTOMATICALLY SIGNALLING AND STOPPING RAILWAY TRAINS FOR THE PREVENTION OF COLLISIONS. A. Manciati. July 22nd, 1916. (108,299.)
17,464. GLASS-BLOWING APPARATUS. British Thomson-Houston Co. (General Electric Co., U.S.A.) December 5th, 1916. (109,544.)
17,983. PRODUCTION AND MAINTENANCE OF HIGH VACUA AND THE PURIFICATION OF NOBLE GASES. British Thomson-Houston Co. (General Electric Co., U.S.A.) December 14th, 1916. (109,358.)
18,005. MACHINES FOR MAKING BATTERY CUPS, AND THE METHOD OF MANUFACTURE. S. L. Casella. December 23rd, 1915. (102,952.)
18,341. DRIVING ARRANGEMENTS OF ELECTRIC MOTORS. G. Jones. December 21st, 1916. (109,367.)

1917.

237. SELF-STARTERS FOR INTERNAL-COMBUSTION ENGINES. C. F. L. King. January 5th, 1917. (109,372.)
238. SELF-STARTERS FOR INTERNAL-COMBUSTION ENGINES. C. F. L. King. January 5th, 1917. (109,373.)
414. ELECTRIC STARTING DEVICES FOR INTERNAL-COMBUSTION ENGINES. V. A. Trier. January 9th, 1917. (109,376.)
3,976. SPARKING PLUG FOR INTERNAL-COMBUSTION ENGINES. W. C. Mathews. March 19th, 1917. (109,403.)
4,554. ENGINE STARTER. V. Benedix. March 29th, 1917. (109,583.)
4,560. ENGINE STARTER. V. Benedix. March 29th, 1917. (109,407.)
6,255. CONTROLLERS FOR ELECTRIC MOTOR CIRCUITS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) May 2nd, 1917. (Addition to 103,441.) (109,418.)
7,409. CONTROL DEVICE OR GOVERNOR FOR ROTARY PUMPS. G. & J. Weir and J. G. Weir. May 23rd, 1917. (109,421.)